PHILOSOPHICAL

TRANSACTIONS

OF THE

ROYAL SOCIETY

OF

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FOR THE YEAR MDCCCXLVII.

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MDCCCXLVII.

Adjudication of the Medals of the Royal Society for the year 1847 by the President and Council.

The Copley Medal to Sir John Frederick William Herschel, Bart., F.R.S., for his work entitled "Results of Astronomical Observations made during the years 1834, 1835, 1836, 1837 and 1838, at the Cape of Good Hope; being a completion of a Telescopic Survey of the whole surface of the visible heavens, commenced in 1825."

The Royal Medal in the department of Chemistry, to George Fownes, Esq., F.R.S., for his Papers entitled "An Account of the Artificial Formation of a Vegeto-alkali," and "On Benzoline, a new Organic Salt-base from Bitter Almond Oil," published in the Philosophical Transactions for 1845.

No recommendation of the Royal Medal in the department of Mathematics having been received, it was awarded to William Robert Grove, Esq., F.R.S., for his Papers entitled "On the Gas Voltaic Battery.—Voltaic Action of Phosphorus, Sulphur and Hydro-carbons," and "On certain Phenomena of Voltaic Ignition and the Decomposition of Water into its constituent Gases by Heat," published in the Philosophical Transactions for 1845 and 1847.

The Bakerian Lecture for 1847 was delivered by William Robert Grove, Esq., M.A., F.R.S., and is contained in his paper entitled "On certain Phenomena of Voltaic Ignition and the Decomposition of Water into its constituent Gases by Heat."

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PHILOSOPHICAL TRANSACTIONS.

XI. *On the Amount of the Radiation of Heat, at night, from the Earth, and from various bodies placed on or near the surface of the Earth.* *By* JAMES GLAISHER, *Esq., of the Royal Observatory at Greenwich. Communicated by* G. B. AIRY, *Esq., F.R.S., Astronomer Royal, &c.*

Received January 14,—Read February 4, 1847.

IN the Report of the Committee of Physics of this Society in the year 1840, the measure of the radiation of heat at night from the earth was specially mentioned as being of importance to meteorology; and it may be added that it is of the utmost importance to the economy of nature.

As soon as the duties of the Magnetical and Meteorological Observatory permitted, I employed some time in making myself acquainted with all that was known upon the subject of radiation. The results of my researches were only a few papers in the Transactions of this Society, and the Treatise on Dew by Dr. WELLS; and in general I found a great want of good observations; I therefore determined to pursue the subject with some degree of steadiness. The instrument recommended to be used in the report above referred to, was a self-registering minimum thermometer, placed in the focus of a polished metallic reflector; and, in consequence of this recommendation, the instrument has been in very general use; it was, however, mentioned as being an imperfect instrument.

The instrument being thus confessedly imperfect, it became exceedingly desirable to ascertain the amount of its errors; and, to this end, to have very many comparisons made between it and those instruments or methods which might be found less imperfect, so as to have a ready and certain means of converting the results derived from observations by it to other results, if it were found desirable so to do. With this view the thermometer, whose bulb was placed in the focus of a reflector, has been read, almost without exception, in every series of experiments.

My first object was the obtaining instruments of the best possible kind, and I con-

sidered that the essentials of the thermometers adapted to the investigation were threefold, viz.—

1st. That the points corresponding to the freezing and boiling of water be exactly determined.

2nd. That the column of mercury which fills the tube be exactly uniform throughout.

3rd. As bodies exposed to the sky must radiate as much heat to it during the prevalence of wind as they would do if the air were still, and as I had always found, during the continuance of the strongest and most steady winds, that there were periods of calms of some duration, it was necessary that the thermometers should be of the most delicate kind, and the most sensitive to the variations of heat, so that they would mark a superficial or transitory cold, as, if not, the frequent application of warm air in windy weather would quickly return a heat equal to that lost by radiation.

With the view of obtaining instruments combining these essentials, I placed myself in correspondence with Mr. Watkins, optician, in the year 1842, described to him the kind of instrument I wanted, and the purpose for which I required them, and after this time I frequently received different thermometers from him for the purpose of experiment. I was thus occupied during many months in making these experiments upon thermometers whose stems were varied in their lengths, some embracing an extent of upwards of 212°; others of a less extent, but whose lengths for a degree were different; to some of these divided scales were applied, varied in their kind and form, hinges being furnished to several, so that a part of the stem and the bulb were free; and others were without any scales affixed to them whatever, the divisions being cut on their own stems; other experiments were made upon thermometers whose bulbs were varied with respect to their form, size and colour; and in general, the results of the experiments tended to the obtaining of instruments which would give the most accurate results.

The following are some of the results of these experiments:—

Being desirous of testing the points 32° and 212° myself, so that I could determine their errors, as also the errors of the other parts of the scale by means of Bessel's formula (Konigsberg Astronomical Observations for 1821, p. 9)*, I was anxious for instruments whose extent of division should embrace these points; I soon, however, abandoned this idea, as it would have required thermometers with very long stems, a circumstance I found materially to affect their readings, which varied with every different inclination of the thermometer to the horizon, and were correct only when placed horizontally. I did this the more readily as I was in possession of an instrument which had been made for me by Messrs. Watkins and Hill ten years previously, the point corresponding to 32° of which had been examined every year, and found to be correct; the readings of this instrument had also been compared with the best standard instruments we possess, and found to agree with them at every part

* See a full illustration of this method in Kupffer, Annuaire Magnétique et Météorologique for the year 1841, pp. 41 to 51.

of the scale; I therefore determined to use this as a standard with which to compare every thermometer.

I also found that it was absolutely necessary to have the division marked on the thermometer stems themselves; for those to which scales were affixed, even those furnished with hinges, so that a part of the stem and the bulb were free, and those whose bulbs projected beyond the scale could not be laid so nicely on different substances as those without scales; for that and other reasons all the thermometers used in the following experiments were without scales affixed to them, the divisions being engraved and coloured upon the stems themselves.

In the course of the experiments I found that circular bulbs were the more sensible in proportion to their smallness, but with a bulb sufficiently small to have the desired sensibility, the column of mercury was so fine that it would have been impossible to observe accurately with it at night in the position in which the instruments were necessarily placed in these observations.

The length of the thermometer finally used was thirteen inches, including the bulb, whose diameter was a quarter of an inch, and length three quarters of an inch (as shown in the figure); therefore, as the instruments were divided from 0° to 130°, each degree was about 0·1 inch in length; these were used during the night observations, and they were left on their respective substances till about 9 o'clock in the morning, until it was found that many of them were broken; the absorptive power of grass and the filamentous substances being such that before this time a temperature of more than 130° had taken place even in the month of April; other instruments were afterwards constructed both of the same length and of the same form, and graduated as far as 160° or 170°. These were occasionally used during the night observations, and always during those of the day in experiments upon the absorptive powers of different substances.

These instruments were so delicate that on taking them from air of the temperature of 60° to that of 37°, the latter temperature was indicated in about two minutes; and therefore if at any time a lull took place in a gale of wind of two minutes' duration, or even less, the amount of heat lost by radiation under the then state of the sky would be correctly registered by these instruments.

On September 13, 1843, I received twenty-five mercurial thermometers of the above form, and as many self-registering minimum thermometers, with circular bulbs, whose divisions were also on their own glass stems; and at this time I commenced the regular series of observations with the mercurial thermometers; that with the minimum thermometers had been begun long before. A year was consumed in these preliminary experiments, and in ascertaining the precautions necessary to obtain correct determinations; in consequence of several of these being neglected before this time, the previous observations must be regarded as undeserving of confidence; the results from them therefore have been omitted in the following Tables.

I now proceed to speak of the comparison of the thermometers with the

standard. Among others received in January 1843, were five of the form finally adopted for use, and the following are the comparisons with the standard, made by hanging them in the air and near to the latter :—

1843. Month, day, and hour.	Reading of standard thermometer.	Reading of thermometers.				
		a.	b.	c.	d.	e.
d. h.	°	°	°	°	°	°
Feb. 5 22	34·8	34·8	34·8	34·8	34·8	34·7
6 0	35·7	35·4	35·6	35·6	35·6	35·7
6 1	36·4	36·2	36·3	36·2	36·3	36·3
13 22	35·9	35·8	36·0	35·8	35·9	35·9
13 22½	36·4	35·9	36·0	36·1	36·2	36·3
13 23	37·0	36·8	37·0	37·0	37·0	37·4
14 1	39·0	38·8	39·0	39·2	39·2	39·2

The following comparisons were made of those received on September 13th by means of water of different temperatures in the following manner. Water of a higher temperature than needed was placed in a vessel, and the required temperature was obtained by the application of cold water, the two being well mixed together till the standard thermometer read the same at every part of the mixture. The thermometers were then all placed in it and parallel to each other ; they were thus allowed to remain for one hour, and their readings were taken quickly. Water of a different temperature was then prepared in a similar way, and so on successively. The comparisons occupied an entire night, and during this interval of time the temperature of the room was kept uniform, in fact it did not vary one degree.

This method was found to be very troublesome, and to ensure accuracy a long time was required to be devoted to it. The mixing of water of different temperatures together, so that the whole mixture became of the same temperature, from the circumstance of its being so bad a conductor of heat, was found to be difficult. After this time I adopted the following method in all subsequent comparisons :—

1st. The water was heated to a temperature above the highest required.

2nd. The standard and all the thermometers for comparison were placed, in this water, parallel to each other, and after some time their readings were taken as quickly as possible.

3rd. The readings were afterwards taken as the temperature of the water declined every 2° or 3°, till the temperature of the water was at or near that of the apartment ; in case the decline of temperature was found to be too rapid, the surface of the water was covered by flannel.

4th. A quantity of water was cooled to a point lower than the lowest required temperature, by means of ice, or of ice and salt, and the thermometers were placed in this as before.

5th. The readings of all the thermometers were taken as this mixture increased 2° or 3° in temperature, till it was at or near the temperature of the apartment, its surface being covered by flannel if the increase of heat was thought to be too rapid.

By this means the comparisons were made with ease and certainty, and they readily indicated every inequality of the thermometer tubes.

1843.	Greenwich mean time Oct. 21d.				Correction to be added to readings of the thermometers.
Name or letter of reference of the thermometer.	7h 30m.	11h 30m.	15h 30m.	17h 40m	
Standard.	45°·1	49°·8	69°·3	90°·5	
A.	45·1	49·8	69·3	90·5	
B.	45·1	49·8	69·3	90·5	
C.	45·1	49·8	69·2	90·5	
D.	45·0	49·8	69·3	90·4	
E.	45·1	49·8	69·3	90·3	
F.	45·1	49·8	69·3	90·4	
G.	45·0	49·8	69·3	90·4	
H.	45·1	49·9	69·3	90·5	
I.	45·1	49·8	69·2	90·4	
J.	45·0	49·7	69·3	90·4	
K.	45·0	49·7	69·3	90·4	
L.	45·0	49·8	69·3	90·4	
M.	45·0	49·8	69·3	90·4	
N.	45·1	49·8	69·3	90·5	
O.	45·1	49·9	69·4	90·5	
P.	44·6	49·4	69·0	90·0	Add 0°·5 to all readings.
Q.	44·9	49·6	69·2	90·3	Add 0°·2 to all readings.
R.	45·0	49·8	69·3	90·5	
S.	44·8	49·5	69·0	90·2	Add 0°·3 to all readings.
T.	44·8	49·5	69·0	90·2	Add 0°·3 to all readings.
U.	45·1	49·8	69·2	90·5	
V.	45·1	49·6	69·2	90·5	
W.	45·1	49·7	69·1	90·5	
X.	45·1	49·8	69·1	90·5	
Y.	45·1	49·6	69·0	90·4	

During the operation of comparing the thermometers, it was found absolutely necessary to have all of them in the same position with respect to the vertical, for it sometimes happened that their readings varied with their position; this variation with the self-registering minimum thermometers was so great that I could not compare them at this time; afterwards I procured a shallow vessel of sufficient extent to receive them horizontally; in this vessel the comparisons were taken, and their readings were found to agree with those of the standard to 0°·1 or 0°·2, the same thermometer being frequently as much in excess at one part of the stem, and as much in defect at another.

The possession of upwards of fifty instruments whose extreme difference of reading from the standard was a constant quantity of half a degree in one thermometer, and a constant quantity of 0°·2 or of 0°·3 in three others, the remainder being absolutely free from error, was exceedingly gratifying. I felt that all the time and trouble I had bestowed on them was well repaid. I had not expected to be so successful in obtaining so many essentially good thermometers, and I had prepared myself to ascertain their errors at every division by Bessel's formula, which, although implying a long process, gives good results; all this trouble, however, I was saved, and also

all the work which would have been necessary in applying the correction, had such been needed.

The construction of such instruments must be considered as highly creditable to Messrs. Watkins and Hill, and I feel that I should be doing an injustice to Mr. Watkins, did I not here mention my obligations to him for his readiness at all times to meet my wishes, which I fear were sometimes troublesome.

The observations were made in the grounds attached to the Royal Observatory, being S.S.E. of the Magnetic Observatory, and distant from it about forty feet.

The form of the piece of ground is nearly square; its extent about 10,000 square feet, and its surface nearly level. At one end is the extreme south arm of the Magnetic Observatory, whose height is twelve feet and breadth thirteen feet; at fourteen feet north of this arm, the two east and west arms project each fourteen feet, and their height is the same as the south arm. On each of the three remaining sides, at the distance of about forty-five feet, is a close wooden fence, between five feet and six feet high. At the distance of ninety feet north-west is a fine and spreading oak-tree, and a little beyond it are other trees but of a less elevation. On the east and near the outside of the fence are chestnut-trees. All these circumstances had influence on the readings, and caused them to be higher (particularly those that were made on or near the surface of the ground), and therefore the differences of the readings, as compared with those in the air, were less than they would have been if the surrounding fence and trees had been further removed, or the observations had been made in a wide and open plain, and I have reason to believe to a much greater extent than would at first appear to be the case.

A portion of the grass plat containing 210 square feet, whose nearest part was twenty-eight feet south of the Magnetic Observatory, was enclosed by low and open palings; within this enclosure the self-registering minimum thermometers were placed after April 1843, and some of them continued to be regularly observed till the present time (1847). At one angle of this enclosure a piece of board six feet long, four feet wide, and $1\frac{1}{4}$ inch thick, was elevated three feet above the grass plat, by means of four props of equal height; upon this raised board all experiments upon substances in the shape of powder were made.

I now proceed to speak of some of the substances upon which experiments have been made. Those on the temperature of grass were always made both on long and on short grass, the blades of the former being bent by strong pressure towards the earth, and overlapping each other so as to completely cover the surface of the ground; the blades of the latter, being less than an inch in height, were erect and stiff; in this respect only did the latter differ from the former, each portion being a part of the same grass plat, separated from each other by a few feet only, and therefore exposed to the same portions of the sky. The metallic plates used had generally a surface of more than 100 square inches. The thermometers for ascertaining the temperature of the air at distances from one inch to twelve feet from the earth, were placed with

their stems passing through a piece of wood planted firmly in the ground, and whose thickness was two inches and breadth three inches, with the bulbs at least nine inches from the wood.

Bodies in the state of powder were generally in quantity such that about thirty square inches of surface were exposed, and their thickness was about half an inch. The filamentous substances exposed a surface of about 100 square inches, and their thickness was about half an inch. With respect to the other substances, the circumstances under which the observations have been made are sufficiently explained in the section of observations. The thermometer was laid on long grass in such a manner that the bulb was not covered by a single blade; on short grass it rested on the fork of two Y's, so that the bulb was sustained on the top of the grass; on metallic plates it was so laid that the bulb occupied the centre of the plate; on substances in powder it was so placed that the bulb occupied the centre of the mass, and just in contact with it, the stem being supported by pieces of wood; on filamentous substances the bulb occupied the centre, and care was taken that it did not sink within, or was covered by any portion of the substance; and the same plan was adopted throughout all the experiments.

During a series of observations the thermometers were frequently removed from one substance to another; those whose readings were the highest were interchanged with those which were the lowest, and so on: in the case of observations of the same kind of metals at different heights, or of different thicknesses, or indeed in any specific comparison, they were always interchanged among themselves; it is possible that had the same instrument remained on the same substance, or in the same position, a more even set of readings in some cases might have been made: but this interchange of instruments removed all doubt as to the cause of the differences in the readings being altogether due to the difference of position, or to the inherent quality of the body itself upon which the instrument was placed. Some of the other precautions used in taking the observations were as follows. First, the observer approached the instrument at that end which was the most distant from the bulb, and held his breath during the time; and the readings were taken as quickly as possible, so that no heat should be imparted to them from the observer's body. In consequence of their divisions being cut on glass, a difficulty was at first experienced in reading them without placing the reading-lamp too near to the instruments: habit after some time enabled the observer to place the lamp so that the divisions were instantly perceived. Another and a greater difficulty was that of readily seeing the top of the mercury, in consequence of the fineness of its column: after various experiments it was found that this became readily seen by slipping a piece of coloured card under the instrument at about the place where it was known the column terminated: the colours found to answer best were drab and yellow. I may mention here that attention was paid to every precaution that experience suggested, or reflection pointed out as desirable.

Each set of observations may be looked upon as a series of experiments made for the purpose of ascertaining the different tendencies of various bodies to become cold upon exposure to a cloudless sky at night. To many persons it must be a new fact, that a perfectly dry body, placed in contact on all sides with other bodies of the same temperature with itself when the sky is covered by clouds, shall on the sky becoming less cloudy or cloudless, become much colder than those bodies, to so great an amount as is exhibited in the following tables, and that it shall remain so for many hours; yet these circumstances were exhibited in every series of observations*.

The formation of dew was found to depend solely on the temperature of the bodies upon which it was deposited, and it never appeared upon them till their temperatures had descended below that of the dew-point in their locality, as found by observations of a dry and wet bulb thermometer placed in their vicinity.

The amount of water thus deposited was the greatest upon the substances whose temperatures were the lowest: among these bodies glass was found to radiate heat freely, and it very readily became wet with dew. In consequence of this property, the tube of a naked thermometer, which was lying on a substance entirely free from moisture, was frequently found covered by dew, and therefore it seemed probable that the temperature exhibited by the instrument was not that of the body in question. On such instances occurring an attempt was made to correct the error by enclosing the thermometer stem in a tube made of gilt paper; the bulb alone, resting on the substance, remained exposed to the sky. The differences between the readings of a thermometer thus enclosed, and when naked, were found to be sensible, but small in amount; it was observed that when the thermometer was wholly naked, the stem was at times wet when the bulb itself was dry; and at all times much less moisture appeared on the bulb than on the stem, unless the disposition of the substance in question to become cold was the same, or greater than that of glass. The error arising from this cause was chiefly confined to the consequent contraction of the mercury in the stem, and not in the bulb, and which was considered to be avoided by the use of gilt paper: the error in all cases must have been small. It was found that the differences between the temperature of the air and of bodies on the earth, at night, in equally calm and clear weather, was the same at every period of the year, but it was found that the amount of dew deposited during such times was much greater in summer than in winter. This is easily accounted for, from the now well-known relation existing between temperature and moisture. At all seasons of the year, at night, the depression of the temperature of the dew-point below that of the air is small, or the air is in a state of saturation nearly, and therefore in summer a certain diminution of temperature would cause much more vapour to be changed into water, than an equal diminution in winter would do.

Radiation of heat from the earth to the heavens must exist at all times both day and night, and in all states of the sky. Generally, when the sun is above the

* The whole of these observations are placed in the Archives of the Royal Society.

horizon, the heat emitted by it to the earth will overbalance that which the earth radiates upwards; at times however, in places shaded from its direct beams, the amount of heat radiated exceeds that received from the sun and all other sources, and dew will be continually deposited throughout the day. Some instances of this are exhibited in the following Tables.

In taking these observations I have been much assisted by my then colleagues in the Magnetical and Meteorological Department of the Royal Observatory, viz. Messrs. Dunkin, Hind and Paul: these gentlemen frequently, on my commencing a series of observations, continued them as long as circumstances required, or they have begun a series which were continued by myself; and whenever any doubt attached to the readings from the unexpected lowness of the thermometers or other causes, they were always confirmed by one or other of these gentlemen, and afterwards by an interchange of instruments.

I have also to acknowledge my obligations to the Astronomer Royal for his kindness in permitting me to carry on these experiments within the grounds of the Royal Observatory; also for providing me with a skeleton form in which the observations were registered; and also for inclosing the piece of ground within which the registering instruments were placed.

The whole of the calculations have been twice performed by myself at different times, and parts of them, which appeared to be more liable to error than others, have been examined by another person. I believe, therefore, the whole to be nearly correct.

Section I.—*Results of Simultaneous Observations made by Mercurial Thermometers, not self-registering.*

The first process in the reduction of these observations, was to take the difference between the reading of the thermometer, freely suspended in air, at the height of four feet, and protected from the effects of radiation, and the simultaneous reading of every other thermometer.

The next process was to divide these differences into groups, arranged according to the excess of the reading of the thermometer, suspended in the air, above that placed on long grass.

The next step was to collect all these differences under the head of their respective substances for every degree of such excess of air temperature above that of long grass temperature.

The next step was to arrange these numbers according to the dates of their occurrence, and to write out abbreviative remarks which were made at the time of observation; and in this way the following Tables have been formed.

Tables I. to XVI. contain the results deduced from the observations taken between 1843, September 13, and 1843, November 15; Tables XVII. to XXVIII. contain the results from the observations taken between 1843, November 16, and December 31; and Tables XXIX. to XLIV. contain those from observations taken between 1844, January 1, and 1844, May, 1.

Excess of the reading of a thermometer placed in air at the height of 4 feet, protected from the effects of radiation, above the readings of thermometers placed on different substances fully exposed to the

Number of the Tables.	1843. Astronomical day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																							
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wool.	One inch below surface of cotton under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On garden mould.	On gravel.	On river sand.	On river sand on the raised board.	One inch high above grass.	Two inches high above grass.	Three inches high above grass.	Six inches high above grass.	Twelve inches high above grass.	On unwrought white cotton wool on grass.	On unwrought white cotton wool on raised board.	On raw wool on raised board.	On flax on raised board.
	h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
I.	Sept. 13. 19 20	54·8	−2·2	−2·2	...	...	...	...	...	...	...	...	0·0	−3·2	−2·2	−2·2	0·8	...	...	−2·2	−2·2	...	...
	17. 19 20	61·5	−0·7	−0·2	...	...	−1·0	...	...	...	...	−1·0	0·0	−0·5	−1·3	−1·2	...	1·7	...	...	...	...	...
	22. 18 0	52·2	−1·1	−0·8	...	...	0·0	...	...	...	...	...	...	−1·4	...	0·4	...	0·4	...	...	−2·3	...	...
	22. 19 20	54·2	−2·3	−1·1	...	...	−0·8	...	...	...	...	...	...	−1·8	...	0·2	...	0·9	...	...	−3·8	...	...
II.	24. 18 40	49·0	0·2	0·9	...	...	2·0	1·0	...	...	...	...	...	0·0	...	1·0	...	1·7	...	...	−0·8	...	...
	26. 19 20	44·5	0·8	1·3	...	...	0·5	...	...	...	...	...	...	−1·7	...	0·5	...	1·3	...	...	−2·7	...	...
	Oct. 15. 19 20	39·0	0·4	1·7	2·4	2·2	−0·1	1·3	...	...	...	...	...	...	...	1·7	...	...	1·2	...	2·2	...	...
III.	Sept. 24. 18 15	48·7	1·3	1·6	...	...	2·6	1·6	...	...	...	−0·1	...	...	...	1·7	...	1·8	...	...	0·4	...	...
	26. 17 35	40·8	1·7	1·4	...	...	2·4	...	...	...	...	...	...	0·3	...	1·2	...	1·6	...	...	1·0	...	...
	Oct. 16. 14 50	40·0	1·0	1·0	1·0	1·0	2·0	0·5	...	...	...	...	...	...	...	1·0	...	1·0	...	...	1·0	...	...
IV.	Sept. 18. 17 30	60·3	2·5	2·1	...	...	...	...	...	...	...	1·3	2·5	2·3	...	2·3	...	1·7	...	...	2·0	...	...
	Oct. 3. 11 35	58·3	2·6	2·3	...	...	1·7	0·4	...	...	...	1·8	...	...	...	1·6	...	...	0·7	...	2·5	...	...
	4. 11 20	55·7	2·7	2·7	...	...	1·9	1·7	...	...	...	...	...	2·7	...	2·7	...	...	2·7	...	2·5	...	...
	12. 18 25	38·5	2·5	2·5	2·0	2·5	2·5	2·5	...	...	...	...	...	...	...	2·5	...	...	2·0	...	2·5	...	...
V.	Sept. 20. 18 20	50·7	3·7	3·0	...	...	2·5	...	...	...	...	1·5	...	...	...	1·9	...	2·1	...	...	4·7	...	...
	21. 13 20	57·2	3·2	3·0	2·9	...	0·7	...	...	...	...	...	...	2·6	...	2·1	...	0·6	...	...	...	...	...
	22. 15 36	50·5	3·3	2·9	1·3	...	2·9	1·1	...	...	...	...	...	2·3	...	3·3	...	1·2	...	...	...	...	...
	Oct. 12. 17 15	38·0	3·2	3·2	5·0	5·0	3·0	2·0	...	...	...	...	...	...	...	3·0	...	...	2·0	...	5·0	...	...
	13. 15 20	41·5	3·5	3·0	3·0	2·2	2·7	0·9	...	...	...	...	...	...	...	1·9	...	...	1·2	...	3·0	...	...
	18. 21 0	38·2	3·0	3·0	5·5	4·0	4·5	...	...	...	...	2·7	2·8	0·8	...	3·0	...	1·0	0·8	...	3·5	...	...
	27. 5 0	44·0	3·3	1·8	2·2	2·9	2·0	1·0	−3·0	−1·5	...	0·8	−0·7	0·4	...	2·0	...	1·0	0·9	2·7	...	...	...
	Nov. 3. 7 40	48·1	3·1	3·8	6·7	6·1	3·9	1·1	−0·5	−2·1	...	1·9	2·1	3·3	...	3·1	...	...	0·5	−0·1	5·0	...	...
	4. 7 0	42·5	3·8	2·0	7·0	6·3	2·7	1·5	−5·5	−1·0	...	−0·5	−2·5	−0·6	...	1·5	...	...	0·7	0·2	3·0	...	...
	9. 6 30	32·5	3·5	2·7	2·0	2·0	2·5	0·9	−6·0	−2·3	...	0·5	0·7	0·5	...	...	...	...	−0·3	−0·2	3·5	...	...
VI.	Sept. 13. 15 37	49·5	4·5	4·5	...	...	6·5	...	...	...	...	...	0·5	4·5	4·0	4·5	3·0	...	...	4·5	4·5	...	...
	21. 9 10	60·7	4·7	4·7	...	...	3·9	...	...	...	...	...	...	4·3	...	4·3	...	2·4	...	...	4·5	...	...
	Oct. 3. 15 30	55·6	4·9	4·0	...	...	3·6	2·4	...	...	...	3·2	...	...	...	3·3	...	...	2·4	...	7·3	...	...
	5. 11 0	54·5	4·5	4·1	...	...	3·5	2·0	...	...	...	3·3	...	...	...	3·3	...	...	2·5	...	...	...	...
	13. 11 0	41·5	4·8	4·5	4·7	3·5	4·3	2·0	...	...	...	...	...	...	...	3·5	...	...	1·5	...	4·5	...	...
	13. 20 40	40·5	4·5	3·5	8·5	4·5	2·5	...	...	...	...	...	...	...	...	2·5	...	...	1·5	...	8·5	...	...
	20. 11 20	42·3	4·8	3·8	5·8	5·5	3·8	0·8	−0·7	0·3	...	1·5	1·8	1·5	...	2·3	...	...	0·1	0·1	5·1	...	...
	20. 13 0	44·8	4·0	1·8	3·6	4·0	1·8	0·0	−1·3	1·3	...	0·8	1·0	0·8	...	1·6	...	...	−0·2	−0·2	2·6	...	...
	23. 7 30	49·2	4·3	3·0	5·2	5·0	3·6	0·7	0·0	0·5	...	1·2	1·1	2·0	...	2·4	...	...	0·0	−0·6	4·2	...	...
	Nov. 3. 10 30	52·1	4·1	2·3	4·6	6·1	3·6	0·6	−3·3	4·0	...	2·9	2·6	3·3	...	3·9	...	...	0·6	0·1	4·6	...	...
	7. 9 0	43·1	4·1	5·9	9·1	7·9	5·3	2·3	−3·0	1·9	...	2·3	2·1	1·6	...	3·5	...	...	0·3	0·1	6·1	...	...
	15. 5 10	37·0	4·0	4·0	4·4	4·0	4·2	1·8	−3·0	...	...	...	...	...	...	...	...	...	1·0	0·2	4·0	...	...
VII.	Sept. 13. 15 24	50·0	5·5	6·0	...	...	8·0	...	...	...	...	...	1·0	6·0	5·0	6·0	3·5	...	...	...	6·0	5·5	...
	13. 17 20	51·5	5·5	5·5	...	...	...	...	...	...	...	...	1·0	5·5	4·5	5·5	3·5	...	...	...	5·5	5·5	...
	17. 17 20	58·0	5·2	3·0	...	...	...	...	...	...	...	2·8	1·2	2·9	2·6	2·3	...	1·8	...	...	...	...	...
	20. 16 20	51·0	5·0	3·8	...	...	3·0	...	...	...	...	...	3·8	...	...	4·0	...	2·0	...	...	6·7	...	...
	20. 17 20	50·0	5·8	3·8	...	...	2·2	...	...	...	...	...	3·0	...	...	3·0	...	2·6	...	...	6·9	...	...
	Oct. 2. 9 30	57·2	5·9	4·7	...	...	3·6	1·9	...	...	...	...	...	3·6	...	3·4	...	...	1·8	...	5·2	...	...
	3. 11 10	58·3	5·8	5·7	...	...	3·5	2·3	...	...	...	2·7	...	...	...	2·8	...	...	1·9	...	6·3	...	...
	5. 9 30	53·5	5·2	4·5	...	...	3·5	2·0	...	...	...	.....	...	3·2	...	3·5	...	...	2·5	...	...	...	...
	9. 18 0	39·2	5·2	3·8	...	...	2·7	2·4	...	...	...	−0·8	...	2·7	...	2·2	...	...	2·2	...	...	...	...
	12. 15 15	35·7	5·7	5·9	10·0	7·0	5·9	3·2	...	...	...	...	...	...	...	3·9	...	...	3·2	...	8·2	...	...
	16. 13 0	36·5	5·5	3·5	4·5	4·5	5·5	1·0	...	...	...	...	...	...	...	3·5	...	...	2·5	...	4·5	...	...
	23. 5 15	50·5	5·3	4·7	14·4	9·0	5·5	2·0	−0·4	1·0	...	2·3	2·0	3·5	...	3·3	...	...	1·0	0·3	12·7	...	...

Oct. 16, 14ʰ 50ᵐ; rain falling. Sept. 18, 17ʰ 30ᵐ; after a heavy rain. Sept. 20, 18ʰ 20ᵐ; after the sun had risen, clouds thin in zenith. Oct. 12, 17ʰ 15ᵐ; rain. Oct. 18, 21ʰ 0ᵐ; sun high. Oct. 3, 15ʰ 20ᵐ; the stars are shining dimly. Oct. 5, 11ʰ 0ᵐ; a few stars have been visible occasionally east of zenith. Oct. 13, 20ʰ 40ᵐ; the sun had risen more than two hours. Nov. 3, 10ʰ 30ᵐ; nocturnal rising temperature of the air, and the reading of the barometer is decreasing. Sept. 17, 17ʰ 20ᵐ; deposition of moisture. Oct. 9, 18ʰ 0ᵐ; clouds in every direction. Oct. 12, 15ʰ 15ᵐ; some rain had fallen.

Oct. 18, 21ʰ 0ᵐ. The observations at this time have not been used in subsequent calculations, they were taken after a long series of observations, extending over the whole night. On examining the state of the different substances at this time, it was found that every fibre of cotton wool was encrusted with a beautiful fringe of hoar-frost, and there were a few spikes of ice: raw wool was covered with lumps of ice, and there were some clear transparent flakes of ice, resembling

sky, arranged according to the difference of the readings of the one on Long Grass and that in Air, from observations taken between 1843 Sept. 13 and Nov. 15.

Excess of the reading of the thermometer in air above that placed																																Clouds.		Wind.		
On coarse flax on grass.	On yellow cotton wool on grass.	On yellow worsted on grass.	On yellow flannel on grass.	On blue cotton wool on grass.	On blue cotton wool on raised board.	On white wadding on grass.	On black wadding on grass.	On flannel on grass.	On flannel on raised board.	On raw silk on grass.	On raw silk on raised board.	On silk from cocoon.	On the raised board.	On saw-dust on the raised board.	On black-lead on raised board.	On charcoal on raised board.	On lamp-black on raised board.	On whiting on raised board.	On chalk on raised board.	On tinfoil.	On lead.	On pumice.	On slate.	One-fourth of an inch above water.	On paper on raised board.	Modification.	Amount 0–10.	High or low.	Direction.	Strength 0—6.	Haze, fog, mist, or vapour.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°									
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1·8	...	1·3	...	0·4	...	...	...	1·5	...	1·0	...	...	1·4	1·4	1·2	...	1·8	...	...	...	...	...	...	1·0	...	Cirrostratus	10				
7·2	...	3·4	...	3·1	...	...	...	3·0	3·1	...	...	1·1	...	3·1	2·6	...	2·8	3·8	...	...	0·5	1·5	1·9	...	...	Cirrostratus	10	H.			
5·3	...	1·0	...	0·5	...	...	...	4·3	...	3·0	...	...	...	1·5	0·5	...	0·3	0·5	−0·3	1·0	0·5	0·5	−0·5	...	...	Cirrostratus	10	H.			
2·5	1·5	...	1·5	...	1·3	...	1·5	...	2·0	...	...	...	...	−0·3	1·0	...	...	...	...	...	...	...	0·2	...	...	Cirrostratus	10				
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8·1	5·1	...	3·1	...	...	...	4·0	...	3·9	...	...	...	...	...	...	...	...	...	...	2·7	2·0	2·0	...	...	Clear, nearly	1	...	s.	2	
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7·5	5·5	...	6·3	...	...	...	5·7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Clear					

mica when abundant in granite; every fibre of flax was encrusted with ice, mixed with a few small flakes: raw silk was covered with spikes one-sixteenth of an inch in length, two of which emanated from the same point, and whose angle of separation was 30°: on blue and yellow wool there were many perpendicular spikes one-fourth of an inch in length: flannel was covered with spikes one-eighth of an inch in length, all of which were inclined to the horizon at an angle of 60°: saw-dust was very beautifully covered with spicular fans, formed by several spikes emanating from the same point at all angles greater than 30° with the horizon; these spikes were connected with each other by lateral spikes or bands; the whole forming the appearance of a fan, whose extent was 120°.

Sept. 23, 5^h 15^m. The observations taken at this time have been inadvertently omitted in subsequent calculations.

In the column whose heading is "Direction of Wind," N. denotes north; E. east; S. south; W. west; C. calm, and G. gusts.

TABLE (Continued).

Number of the Tables.	1843. Astronomical day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																				
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of ground under long grass.	On surface of ground under short grass.	On surface of ground under long grass.	On garden mould.	On gravel.	On river sand.	On river sand on the raised board.	One inch high above grass.	Two inches high above grass.	Three inches high above grass.	Six inches high above grass.	Twelve inches high above grass.	On unwrought white cotton wool on grass.	On unwrought white cotton wool on raised board.	On raw wool on raised board.	On flax on raised board.
	h m		°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
VII. (Continued.)	Oct. 25. 21 0	34·1	5·1	4·1	6·1	6·1	4·1	2·1	−7·9	−5·4	...	6·1	4·1	2·1	...	3·1	...	...	1·9	1·9	6·1	2·6	...	...
	26. 17 30	33·1	5·8	2·6	5·4	5·4	4·5	1·2	−7·7	−5·0	...	2·4	3·2	2·0	...	2·3	...	...	1·1	0·0	5·6	...	...	...
	Nov. 3. 5 30	49·3	5·3	5·3	7·5	8·1	6·3	2·0	...	...	...	...	1·5	2·5	...	3·7	...	...	1·4	0·7	7·1	...	...	...
	7. 10 0	42·5	5·0	5·3	8·5	6·5	5·7	2·2	−4·5	0·0	...	3·0	2·7	3·0	...	4·5	...	...	0·3	−0·2	7·0	...	...	5·5
	7. 11 10	43·5	5·5	6·3	9·5	6·5	6·5	2·1	−1·7	2·5	...	3·5	2·5	2·5	...	4·5	...	...	0·5	−0·3	8·5	...	...	4·3
	10. 17 30	34·7	5·7	5·5	6·6	5·5	5·7	3·3	−4·3	1·7	...	3·7	1·7	2·5	...	...	...	...	1·5	0·0	6·1	...	...	...
	12. 13 5	33·0	5·7	5·7	7·7	6·7	4·2	3·7	−3·9	−0·3	...	...	...	...	...	...	...	...	0·7	0·5	5·7	...	...	...
	13. 10 10	34·5	5·5	4·5	4·0	3·5	4·5	2·5	−2·5	2·5	...	...	...	...	...	...	...	...	1·3	1·3	4·0	...	...	...
	15. 4 15	38·0	5·9	5·0	6·5	5·7	7·0	2·5	−2·7	0·7	...	...	...	...	...	...	...	...	3·2	0·8	5·7	...	...	...
VIII.	Sept. 16. 11 20	58·7	6·0	3·7	...	...	4·7	...	...	...	...	4·2	2·7	3·4	3·5	3·5	...	1·2	...	...	...	...	...	...
	17. 12 30	61·9	6·9	3·5	...	...	5·0	...	...	...	...	4·1	2·2	3·6	4·2	3·8	...	2·5	...	...	...	...	...	...
	17. 13 20	60·4	6·5	4·3	...	...	4·2	...	...	...	...	4·2	2·1	3·4	3·3	3·4	...	2·3	...	...	...	...	...	...
	17. 15 20	59·4	6·9	4·4	...	...	3·7	...	...	...	...	3·8	2·7	2·8	2·7	3·6	...	2·4	...	...	...	...	...	...
	20. 13 0	52·6	6·1	4·4	...	...	4·8	...	...	...	...	4·0	...	...	...	3·6	...	2·8	...	...	7·2	...	...	...
	20. 13 50	51·4	6·7	4·6	...	...	5·2	...	...	...	...	...	...	...	...	4·1	...	3·0	...	...	8·4	...	...	...
	Oct. 2. 5 0	61·0	6·0	5·0	...	...	5·0	...	...	...	...	...	...	...	...	4·5	...	...	3·5	...	...	...	...	...
	2. 11 15	53·3	6·3	5·8	...	...	6·0	3·6	...	...	...	...	...	3·3	...	5·5	...	...	3·1	...	3·9	...	...	...
	5. 9 0	53·9	6·3	6·9	...	...	5·4	2·3	...	...	...	...	...	2·7	...	4·7	...	...	2·9	...	...	...	...	...
	5. 10 40	54·0	6·0	4·2	...	...	4·5	2·3	...	...	...	...	...	3·2	...	3·8	...	...	2·6	...	...	...	...	...
	12. 14 0	35·5	6·5	6·0	11·5	7·5	5·5	3·3	...	...	...	...	...	...	...	4·5	...	...	2·5	...	8·0	...	...	...
	12. 18 0	38·0	6·0	6·0	...	...	5·0	2·5	...	...	...	3·2	3·2	3·0	...	5·8	...	...	2·0	...	...	...	...	...
	12. 18 15	38·5	6·5	6·5	9·0	9·5	5·5	2·5	...	...	...	...	...	...	...	4·5	...	...	2·7	...	9·7	...	...	...
	13. 8 0	41·2	6·7	6·2	11·2	9·2	6·2	3·2	...	...	...	...	...	...	...	4·2	...	...	2·2	...	9·2	...	...	...
	16. 9 20	33·7	6·5	4·5	8·7	10·1	7·0	2·2	...	...	...	...	...	...	...	2·7	...	...	1·9	...	8·1	...	...	...
	16. 11 0	32·8	6·8	5·8	9·3	9·3	7·3	3·0	...	...	...	...	...	...	...	4·3	...	...	2·3	...	7·8	...	...	...
	16. 12 10	34·4	6·4	5·4	6·4	6·4	6·7	2·4	...	...	...	...	...	...	...	3·4	...	...	1·6	...	6·4	...	...	...
	16. 14 0	38·0	6·0	3·0	6·0	6·0	2·0	0·5	...	...	...	...	...	...	...	2·0	...	...	1·0	...	6·0	...	...	...
	17. 7 0	39·3	6·8	4·5	9·8	9·3	5·3	2·8	...	...	...	2·8	2·3	2·3	...	3·8	...	...	2·3	1·3	9·3	...	...	...
	18. 17 0	28·5	6·5	6·3	10·5	8·5	9·7	4·7	...	...	...	3·9	0·8	3·0	...	6·1	...	...	3·5	0·3	10·5	...	...	...
	19. 15 30	29·6	6·5	4·6	10·8	10·6	7·1	6·6	...	...	...	4·8	3·6	4·4	...	4·6	...	...	0·6	0·6	10·6	...	...	...
	19. 17 30	29·6	6·6	6·1	9·0	10·6	4·7	3·9	...	...	...	1·8	3·6	5·6	...	5·6	...	...	2·0	1·8	9·0	...	...	...
	19. 19 30	32·5	6·3	5·7	5·7	5·9	5·0	3·3	...	...	...	3·3	1·5	3·5	...	5·5	...	...	2·7	1·5	6·3	...	...	...
	21. 4 25	49·5	6·5	4·3	7·0	6·5	5·5	1·5	−0·5	0·0	...	1·3	2·5	2·7	...	4·0	...	...	2·5	2·0	6·0	...	...	...
	21. 11 30	39·0	6·7	4·5	9·0	8·0	5·3	2·6	−4·0	−1·3	...	3·0	2·0	2·4	...	2·8	...	...	0·6	0·2	6·5	...	...	...
	23. 5 0	50·3	6·5	4·1	8·0	6·5	4·9	1·4	−0·5	0·5	...	2·3	1·0	2·6	...	3·0	...	...	0·1	−0·3	7·1	...	...	...
	26. 5 10	43·5	6·7	2·8	5·0	5·0	3·1	2·0	−4·3	−2·4	...	1·7	0·3	1·3	...	1·7	...	...	−0·7	−0·9	5·0	...	...	...
	26. 15 30	33·1	6·3	3·5	6·4	6·7	4·1	2·6	−7·7	−5·0	...	2·6	4·3	1·7	...	3·8	...	...	1·1	0·0	6·3	...	...	...
	26. 19 0	33·3	6·3	4·3	6·7	7·1	3·0	2·5	−6·7	−8·0	...	2·3	4·3	3·5	...	4·7	...	...	1·3	1·3	5·3	...	...	...
	Nov. 8. 9 10	37·8	6·7	6·7	7·8	8·0	7·8	4·3	−3·4	4·8	...	4·1	3·8	4·1	...	5·8	...	...	2·6	1·8	8·6	...	...	5·8
	8. 11 0	36·6	6·6	6·6	8·6	8·6	7·1	3·6	−4·5	4·6	...	4·6	3·6	4·6	...	6·6	...	...	1·8	1·6	8·6	...	...	6·1
	8. 12 40	41·4	6·4	5·9	7·9	5·9	5·9	1·4	−1·6	1·4	...	1·6	0·9	1·9	...	...	...	...	0·2	0·2	7·4	...	...	4·3
IX.	Sept. 16. 9 10	61·5	7·6	8·3	...	...	5·5	...	...	...	...	6·0	0·7	3·6	4·5	7·5	...	3·7	...	...	...	...	...	...
	17. 11 0	62·3	7·0	6·0	...	...	5·3	...	...	...	...	3·8	1·5	3·3	3·8	4·3	...	2·7	...	...	...	...	...	...
	17. 11 30	62·4	7·6	6·6	...	...	5·6	...	...	...	...	4·5	2·0	4·2	4·3	4·6	...	2·7	...	...	...	...	...	...
	18. 7 30	66·1	7·8	6·3	...	...	6·6	...	...	...	...	5·1	1·8	4·0	3·8	5·5	...	3·4	...	...	...	...	...	...
	20. 10 50	54·5	7·5	5·5	...	...	4·5	...	...	...	...	...	...	3·5	...	7·0	...	3·0	...	...	7·5	...	...	...
	20. 11 20	54·2	7·7	6·0	...	...	6·2	...	...	...	...	4·2	...	...	...	4·2	...	3·0	...	...	8·7	...	...	...
	20. 14 30	51·7	7·3	5·0	...	...	4·7	...	...	...	...	...	...	3·4	...	4·3	...	2·9	...	...	8·7	...	...	...
	24. 17 35	47·5	7·1	7·7	...	...	8·4	2·5	...	...	...	...	2·8	...	...	5·0	...	3·2	...	...	7·5	...	...	...
	27. 18 0	40·4	7·9	6·6	...	...	6·0	4·4	...	...	...	...	5·4	...	...	5·9	...	4·4	...	...	9·9	...	...	...
	27. 18 22	39·7	7·5	7·4	...	...	7·9	3·2	...	...	...	...	...	4·9	...	4·7	...	3·7	...	...	8·2	...	...	...
	27. 19 10	41·0	7·0	6·2	...	...	6·5	...	...	...	...	...	...	4·5	...	5·0	...	3·5	...	...	9·0	...	...	...
	Oct. 5. 5 20	60·3	7·3	6·1	...	...	5·8	0·8	...	...	...	...	−0·2	...	...	3·7	...	...	2·9	...	...	...	...	...

Oct. 25, 21h 0m; the ice in evaporator is 0·5 in thickness three hours after sun-rise. Nov. 3, 5h 30m; scud and vapour. Nov. 7, 11h 10m; dew abundant. Sept. 16, 11h 20m; a great deposition of moisture. Sept. 17, 12h 30m; the stars nearly obscured. Sept. 17, 13h 20m; a few stars visible in the zenith. Sept. 20, 13h 0m; dew. Sept. 20, 13h 50m; dew. Oct. 2, 5h 0m; zenith clear. Oct. 12, 18h 15m; zenith clear. Oct. 17, 7h 0m; shortly after rain had fallen. Nov. 8, 9h 10m; no dew. Sept. 16, 9h 10m; the stars look small. Sept. 17, 11h 0m; zenith clear. Sept. 20, 11h 20m; dew. Sept. 20, 14h 30m; dew. Sept. 27, 18h 0m; hoar-frost. Sept. 27, 18h 22m; hoar-frost; the sun up. Sept. 27, 19h 10m; hoar-frost disappearing.

Oct. 25, 20h 0m. On examining the several substances at this time, it was found that cotton wool was covered with spikes of ice one-sixteenth of an inch in thickness: on raw wool there were a few flakes of clear ice, and a few spikes; also each fibre was encrusted with small round particles of ice: on blue and yellow wool the spikes were abundant, and all were inclined to the horizon at an angle of 30°: on every fibre of raw silk there were two spikes emanating from the same point and at right angles to the fibre, and inclined to the horizon at an angle of 30°: on black-lead, which substance was white with hoar-frost very early, there were clusters of spikes one-tenth of an inch in length, and inclined to the horizon at all angles: on charcoal there were clusters of spikes: on whiting there were spikes at all angles: on flannel the spikes were one-eighth of an inch in length: on saw-dust the spikes were in bunches, many of which were of a fan-like shape: and on wood there were many spikes.

Oct. 13, 20h 40m. After this observation, the three substances, raw wool, cotton wool and flax, were frequently examined, for the purpose of ascertaining the time that each substance became free from dew; the sun was shining on all of them; it was noticed at 22h 50m that flax was free; at 14d 1h 50m cotton wool was just free, but on raw wool small drops of water continued throughout the day.

Table (Continued).

| Excess of the reading of the thermometer in air above that placed | | |

TABLE (Continued).

Number of the Table.	1848. Astronomical day, Local mean time.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																				
			On long grass.	On short grass.	On grass wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On garden mould.	On gravel.	On river sand.	On river sand on the raised board.	One inch high above grass.	Two inches high above grass.	Three inches high above grass.	Six inches high above grass.	Twelve inches high above grass.	On unwrought white cotton wool on grass.	On unwrought white cotton wool on raised board.	On pure wool on raised board.	On flax on raised board.
IX. (Continued.)	h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
	Oct. 5. 7 20	55·4	7·4	6·6	...	...	5·2	0·9	...	...	...	...	1·4	...	...	4·6	...	...	3·2	...	...	...	...
	9. 10 20	44·5	7·7	5·3	...	...	5·2	5·1	...	...	...	...	1·7	2·0	...	5·0	...	...	4·0	...	...	...	...
	9. 11 10	44·0	7·7	6·0	...	...	5·4	3·5	...	...	...	6·0	2·6	...	...	6·0	...	...	4·3	...	...	...	...
	12. 11 0	37·1	7·1	3·6	...	...	5·1	2·8	...	...	...	3·1	2·3	2·6	...	3·6	...	...	2·1	...	...	...	...
	12. 11 23	36·8	7·0	4·8	7·8	8·8	5·3	2·8	...	...	...	...	...	...	...	3·8	...	...	2·2	...	8·8	...	...
	12. 12 0	36·5	7·0	4·7	9·0	8·5	5·5	3·5	...	...	...	...	...	...	...	4·2	...	...	2·3	...	9·0	...	...
	13. 5 15	43·5	7·5	5·5	...	...	5·5	1·5	...	...	...	3·5	1·5	1·5	...	4·0	...	...	1·5	...	...	...	...
	13. 18 55	37·6	7·9	7·0	7·8	9·9	8·2	3·6	...	...	...	...	...	...	...	5·3	...	...	4·1	...	10·6	...	...
	14. 9 30	36·8	7·4	6·3	7·8	9·3	8·2	2·8	...	...	...	...	...	...	...	5·0	...	...	3·1	...	8·1	...	...
	16. 7 20	35·0	7·8	5·7	8·2	12·0	7·2	2·6	...	...	...	...	...	...	...	4·0	...	...	1·8	...	8·8	...	...
	16. 11 25	33·8	7·6	5·8	10·3	10·5	7·8	2·8	...	...	...	...	...	...	...	3·8	...	...	2·0	...	9·0	...	...
	16. 12 0	34·0	7·0	6·0	9·0	10·0	7·5	2·0	...	...	...	...	...	...	...	3·5	...	...	1·2	...	8·0	...	...
	20. 9 20	42·1	7·1	4·1	7·3	9·1	5·1	1·4	– 1·9	–0·1	3·1	2·3	2·4	2·9	...	3·1	...	...	...	...	9·1	...	...
	20. 11 0	42·0	7·0	4·5	10·8	10·0	7·0	2·0	– 1·0	0·0	3·0	3·0	3·0	3·3	...	3·0	...	...	1·0	0·2	6·8	...	...
	25. 19 30	31·0	7·0	5·0	9·0	8·7	5·0	3·0	–10·3	–6·3	4·2	1·4	–0·2	0·6	...	4·2	...	...	1·4	1·3	7·5	6·2	...
	26. 11 30	35·6	7·2	4·9	5·8	8·4	5·6	3·1	– 6·4	–4·4	5·3	1·4	5·8	2·8	...	5·3	...	...	1·4	0·9	6·2	...	...
	Nov. 7. 7 30	46·2	7·6	7·4	14·2	11·9	9·0	4·5	– 1·6	5·2	7·2	...	3·4	3·6	...	7·2	...	...	3·0	1·2	12·2	...	...
	11. 9 50	37·5	7·0	7·0	10·3	9·5	9·7	2·2	– 0·5	3·5	...	4·5	3·5	3·7	...	...	...	...	3·1	1·7	7·7	...	7·5
	11. 12 0	35·5	7·5	6·5	10·9	9·5	7·8	3·5	– 1·9	1·5	...	3·5	2·5	4·2	...	...	...	...	1·4	0·5	7·5	...	7·5
X.	Sept. 13. 15 20	49·5	8·7	8·5	...	...	11·0	...	...	...	...	...	1·5	7·0	5·0	8·5	4·5	...	...	...	9·5	8·3	...
	15. 9 10	61·5	8·5	7·0	...	...	6·0	...	...	...	...	5·0	1·9	3·5	5·3	5·5	...	2·5	...	...	8·5	...	...
	18. 8 0	65·3	8·0	5·9	...	...	6·2	...	...	...	...	3·5	5·3	3·8	...	6·1	...	3·1	...	...	...	...	...
	18. 11 20	60·3	8·0	6·1	...	...	8·6	...	...	...	...	...	0·1	...	...	7·6	...	4·1	...	...	9·4	...	...
	20. 8 45	57·6	8·6	8·6	...	...	8·8	...	...	...	...	5·8	2·8	...	...	7·8	...	4·3	...	...	10·8	...	...
	20. 9 55	57·3	8·5	8·8	...	...	6·1	...	...	...	...	4·3	1·3	4·1	3·9	5·3	...	3·3	...	...	...	...	...
	20. 11 40	54·2	8·4	7·5	...	...	6·2	...	...	...	...	...	2·0	...	...	4·3	...	3·0	...	...	8·7	...	...
	20. 15 20	52·0	8·5	7·6	...	...	6·0	...	...	...	...	...	2·7	...	...	6·4	...	4·0	...	...	9·2	...	...
	21. 18 45	51·8	8·3	7·4	...	...	5·8	...	...	...	...	...	...	4·0	...	6·0	...	3·1	...	...	8·1	...	...
	23. 5 40	62·6	8·1	6·6	...	...	6·2	1·6	...	...	...	...	...	2·6	...	4·4	...	3·4	...	...	9·4	...	...
	23. 7 30	58·3	8·3	6·8	...	...	7·3	2·3	...	...	...	...	1·1	...	...	8·1	...	3·7	...	...	9·5	...	...
	23. 11 35	52·1	8·2	7·1	...	...	5·6	2·1	...	...	...	6·6	...	...	...	7·1	...	3·9	...	...	7·2	...	...
	24. 13 30	52·5	8·5	7·1	...	...	6·8	3·5	...	...	...	5·5	...	...	...	5·0	...	3·8	...	...	8·0	...	...
	27. 11 30	41·2	8·7	7·4	...	...	8·2	4·2	...	...	...	7·2	...	...	...	6·2	...	4·0	...	...	11·4	...	...
	27. 15 15	39·8	8·8	7·3	...	...	7·3	3·8	...	...	...	...	...	6·0	...	5·0	...	3·8	...	...	10·3	...	...
	27. 17 15	39·5	8·0	8·0	...	...	7·5	3·9	...	...	...	5·0	...	...	...	5·5	...	4·5	...	...	10·0	...	...
	27. 18 48	40·4	8·4	8·4	...	...	8·6	...	...	...	...	...	...	4·9	...	5·4	...	3·4	...	...	10·9	...	...
	Oct. 2. 7 30	57·4	8·4	8·9	...	...	8·5	4·8	...	...	...	...	...	5·4	...	7·4	...	4·6	...	...	9·4	...	...
	4. 7 30	58·0	8·0	7·0	...	...	5·0	3·2	...	...	...	3·0	...	...	...	5·5	...	3·7	...	...	8·8	...	...
	9. 9 20	45·5	8·1	5·5	...	...	6·3	2·9	...	...	...	...	0·3	1·5	...	6·3	...	4·0	...	...	...	...	...
	9. 15 10	40·1	8·6	8·6	...	...	6·6	4·1	...	...	...	2·6	...	2·1	...	8·1	...	3·9	...	...	...	...	...
	12. 13 10	36·2	8·0	6·2	12·2	9·2	6·7	4·0	...	...	...	...	...	...	...	4·8	...	3·2	...	...	9·7	...	...
	13. 18 0	38·4	8·8	6·9	7·1	6·9	8·0	3·3	...	...	...	...	...	...	...	5·4	...	...	3·9	...	9·6	...	...
	13. 18 20	38·1	8·4	6·5	6·8	6·5	7·7	3·6	...	...	...	...	...	...	...	5·3	...	...	4·1	...	9·1	...	...
	13. 18 40	37·6	8·1	7·1	8·8	11·0	8·6	3·6	...	...	...	...	...	...	...	5·9	...	...	4·2	...	11·6	...	...
	13. 19 30	37·2	8·7	7·0	10·2	9·2	8·4	3·1	...	...	...	...	...	...	...	5·5	...	...	4·2	...	9·7	...	...
	14. 5 25	44·6	8·9	7·4	12·0	11·6	8·2	3·6	...	...	...	...	...	...	...	5·4	...	...	3·9	...	11·6	...	...
	14. 7 10	39·5	8·8	7·3	10·8	10·7	8·7	3·5	...	...	...	...	...	...	...	5·6	...	...	3·5	...	10·0	...	...
	15. 17 20	30·5	8·7	8·7	...	11·0	10·7	5·3	...	...	...	...	...	...	...	9·3	...	...	5·3	...	11·7	...	...
	20. 5 20	45·6	8·9	4·6	10·2	9·1	11·0	...	– 1·6	0·8	...	2·0	1·4	3·0	...	3·1	...	...	0·6	–0·2	7·4	...	...
	21. 5 0	48·2	8·2	5·5	9·2	8·9	5·2	2·1	– 1·0	0·0	...	2·2	2·2	3·2	...	4·5	...	...	2·5	2·1	8·7	...	...
	25. 15 0	32·9	8·1	7·5	11·0	11·5	7·9	4·4	– 9·6	–3·4	...	2·8	–0·1	2·4	...	...	...	...	2·2	1·3	8·9	...	...
	25. 18 15	30·3	8·0	6·7	10·6	11·1	6·8	3·9	–11·0	–6·7	...	2·5	0·3	1·3	...	...	...	...	1·9	1·4	9·0	8·8	...
	26. 9 0	38·3	9·3	7·1	10·0	9·8	7·3	3·0	– 4·7	–1·7	...	2·7	2·3	2·7	...	...	...	...	1·3	0·8	8·3	...	...
	Nov. 1. 8 30	38·0	8·0	6·0	10·5	10·5	6·0	3·0	– 6·0	–4·0	...	2·5	–1·0	2·0	...	...	...	...	2·0	1·5	10·0	...	...
	11. 5 30	40·5	8·3	5·4	8·5	8·3	6·0	2·5	– 2·3	–2·5	...	1·7	1·3	2·4	...	...	...	...	5·3	1·3	8·8	...	8·3
	12. 20 30	30·6	8·6	7·6	10·1	9·8	6·1	3·9	– 4·2	0·6	...	...	...	...	...	...	...	...	2·6	2·3	9·6	...	...
	13. 9 0	33·0	8·1	6·0	9·2	8·6	8·4	3·5	– 4·0	2·0	...	...	...	...	...	...	...	...	1·9	1·7	7·0	...	...

Oct. 14, 9ʰ 30ᵐ; the stars very dim. Sept. 15, 9ʰ 10ᵐ; horizon thick. Sept. 21, 18ʰ 45ᵐ; great deposition of moisture. Sept. 24, 13ʰ 30ᵐ; the stars appear to be dim and small. Sept. 27, 15ʰ 15ᵐ; hoar-frost. Sept. 27, 17ʰ 15ᵐ; hoar-frost. Sept. 27, 18ʰ 48ᵐ; hoar-frost.

Oct. 12, 11ʰ 0ᵐ. The thermometer placed on long grass was thickly encrusted with hoar frost. At the time of the deposition of dew the readings of all the thermometers increased which became wetted by it; that is, of every instrument whose reading was less than the temperature of the dew-point. The first appearance of dew was in very minute drops on the pointed ends of long grass, which on receiving an increase of water flowed down the blades.

Oct. 21, 5ʰ 0ᵐ. At this time 10 grains of wool were placed on grass, and a similar parcel was placed on the raised board; at 7ʰ 30ᵐ the former was found to weigh 12·1 grains, and the latter 10·7 grains; the glass stems of all the thermometers were wet with dew, though the substances upon which they were placed were not yet wet; at 19ʰ the weight of the parcel which was placed on grass was 17 grains, that placed on the raised board had blown away.

Nov. 12, 20ʰ 0ᵐ. Wood was covered with spikes of ice one-fourth of an inch in thickness, inclined to the horizon at an angle of 60°, and at all azimuths; on

Table (Continued).

Excess of the reading of the thermometer in air above that placed																										Clouds.		Wind.		
On coarse flax on grass.	On yellow cotton on grass.	On yellow cotton wool on raised board.	On blue cotton wool on grass.	On blue cotton wool on raised board.	On white wadding on grass.	On black wadding on grass.	On flannel on grass.	On flannel on raised board.	On raw silk on grass.	On raw silk on raised board.	On silk from cocoon.	On the raised wool.	On sawdust on the raised board.	On black-lead on raised board.	On charcoal on raised board.	On lamp-black on raised board.	On whiting on raised board.	On chalk on raised board.	On tinfoil.	On lead.	On pasteboard.	On slate.	One-fourth of an inch above water.	On paper on raised board.	Modification.	Amount 0—10.	High or low.	Direction.	Strength 0—6.	Haze, fog, mist, or vapour.
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charcoal and on black-lead there were spikes in rich clusters; those forming one cluster all emanated from the same point, and they were inclined at all angles; on lampblack the spikes were very numerous, being about three-eighths of an inch in thickness, and inclined to the horizon at an angle of about 30°, and at all azimuths, so that each cluster formed a circle, in the centre of which there were no spikes: on sand there were spikes one-fourth of an inch in length, inclined at all angles to the horizon: chalk was covered with a mass of spikes one-fourth of an inch in length: whiting was covered with rich bunches of spikes three-eighths of an inch in length: flax was covered with small sparkling flakes of ice: raw wool was encrusted on each fibre so as to be about six times its own size: cotton wool was completely covered with spikes, and paper was covered with small round particles and a few spikes.

Oct. 13, 17h 50m. At this time the sky was overcast and the readings of all the thermometers were nearly alike; at 18h 0m the instruments were read exhibiting the above large differences.

Table (Continued).

Number of the Table.	1843. Astronomical day, hour and minute.	Reading of Thermometer in air above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																					
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On garden mould.	On gravel.	On river sand.	On river sand on the raised board.	One inch high above grass.	Two inches high above grass.	Three inches high above grass.	Six inches high above grass.	Twelve inches high above grass.	On unwrought white cotton wool on grass.	On unwrought white cotton wool on raised board.	On flax on raised board.	On flax on raised board.
	h m		°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
XI.	Sept. 15. 7 20	63·2	5·9	3·4	...	...	7·7	...	...	...	...	5·2	1·2	3·2	2·2	6·2	...	3·2	...	...	9·2	...	...	...
	15. 11 0	58·8	9·9	8·8	...	...	7·8	...	...	...	...	6·8	3·6	5·3	6·8	7·0	...	3·6	...	...	10·8	...	...	...
	16. 7 40	65·0	9·1	9·0	...	...	7·3	...	...	...	...	6·5	0·3	4·0	3·4	7·0	...	4·2	...	...	...	...	...	...
	18. 9 30	63·0	9·5	9·0	...	...	7·5	...	...	...	...	6·0	3·0	5·3	...	7·2	...	4·5	...	...	10·0	...	...	...
	19. 15 10	53·0	9·3	7·8	...	...	11·0	...	...	...	...	...	3·5	...	...	7·5	...	3·1	...	...	8·7	...	...	...
	20. 10 25	55·5	9·5	9·0	...	...	8·0	...	...	...	...	...	3·0	...	...	7·0	...	4·0	...	...	10·5	...	...	...
	20. 15 0	52·6	9·7	8·3	...	...	6·1	...	...	...	...	5·1	...	...	...	6·9	...	4·6	...	...	10·7	...	...	...
	21. 6 55	62·7	9·7	9·2	...	...	9·2	...	...	...	...	...	1·7	...	...	7·0	...	4·5	...	...	8·2	...	...	...
	21. 7 30	61·5	9·5	8·5	...	...	7·3	...	...	...	...	6·5	...	...	...	7·8	...	4·5	...	...	10·5	...	...	...
	21. 18 20	51·3	9·0	9·0	...	...	8·0	...	...	...	...	...	...	5·9	...	7·5	...	3·5	...	...	10·0	...	...	...
	23. 6 0	61·4	9·7	7·4	...	...	7·4	2·4	...	...	...	5·0	...	...	...	6·4	...	4·1	...	...	11·4	...	...	...
	24. 15 10	50·5	9·0	7·0	...	...	7·9	3·0	...	...	...	...	...	5·5	...	6·0	...	4·1	...	...	10·5	...	...	...
	28. 11 35	45·3	9·5	6·3	...	...	7·3	2·8	...	...	...	...	...	3·9	...	4·8	...	3·4	...	...	10·0	...	...	...
	28. 13 25	43·5	9·6	8·0	...	...	11·3	3·0	...	...	...	7·7	...	...	...	5·5	...	3·8	...	...	12·5	...	...	...
	Oct. 15. 4 50	41·0	9·2	7·1	11·7	12·8	7·6	2·7	...	...	...	...	...	...	...	5·0	...	...	...	3·0	11·8	...	...	...
	15. 5 5	40·5	9·8	7·8	11·7	13·2	9·1	3·2	...	...	...	...	...	...	...	6·2	...	...	...	3·1	12·3	...	...	...
	18. 5 30	42·2	9·8	6·9	12·9	...	7·9	2·8	...	...	...	5·2	4·0	3·9	...	5·2	...	...	...	3·0	9·4	...	...	...
	18. 8 30	35·7	9·7	8·9	11·6	8·2	8·7	3·4	...	...	...	5·7	4·5	4·7	...	6·5	...	...	...	4·5	3·5	11·7	...	...	...
	19. 7 40	35·6	9·6	7·8	12·4	12·1	8·6	3·9	−6·9	−1·1	...	5·4	2·4	3·8	...	6·6	...	...	...	2·6	1·8	10·5	...	...	...
	19. 10 0	33·2	9·0	8·7	11·7	14·7	7·4	4·0	−6·8	−2·3	...	2·7	1·7	2·7	...	6·2	...	...	...	2·3	1·8	10·4	...	...	...
	19. 12 0	31·0	9·5	8·5	13·0	12·8	7·8	3·8	...	...	...	1·8	0·8	3·0	...	8·0	...	...	...	1·9	0·8	11·5	...	...	...
	21. 9 20	42·1	9·9	7·8	12·9	11·3	7·1	3·5	−1·1	−1·3	...	4·7	2·9	4·9	...	7·5	...	...	...	3·3	2·9	9·9	...	...	...
	25. 13 0	35·5	9·3	8·0	12·1	12·5	7·9	4·7	−7·5	−0·5	...	4·5	1·9	3·0	...	6·5	...	...	...	1·9	1·1	9·5	...	...	...
	26. 7 35	40·5	9·3	2·8	10·1	8·9	6·5	3·1	−3·5	−1·0	...	3·0	1·2	3·5	...	5·5	...	...	...	1·3	0·7	8·0	...	...	...
	Nov. 8. 13 0	35·5	9·5	8·3	12·0	11·8	9·3	4·3	−4·5	1·5	...	4·0	4·0	4·0	...	6·5	...	...	...	3·5	2·7	12·0	...	...	...
	8. 13 0	35·1	9·1	7·9	11·6	11·6	9·1	4·1	−4·1	1·1	...	4·1	4·1	3·6	...	5·6	...	...	...	3·0	2·3	11·6	...	...	...
	8. 17 0	33·5	9·0	8·0	11·2	9·5	8·5	3·5	−4·5	1·0	...	4·0	3·0	4·5	...	6·0	...	...	...	2·7	2·2	11·2	...	...	...
	9. 5 30	33·0	9·5	9·5	13·5	13·0	11·5	3·5	−6·0	−1·5	...	2·5	3·2	3·0	...	...	...	...	...	3·2	2·9	13·0	...	...	...
	10. 19 30	33·5	9·3	7·5	10·5	10·5	9·3	2·5	−4·3	−0·7	...	2·0	1·2	2·0	...	...	...	...	...	2·5	1·5	10·5	...	...	...
	11. 7 30	38·8	9·8	8·7	13·8	13·2	9·5	3·3	−1·6	1·8	...	6·0	4·2	4·8	...	...	...	...	...	3·8	2·6	13·7	...	...	10·2
	11. 10 35	37·0	9·2	9·5	10·8	10·5	8·8	3·8	−1·0	3·0	...	5·0	4·0	4·0	...	...	...	...	...	3·8	2·8	10·0	...	...	7·4
	12. 13 5	31·7	9·5	7·2	11·0	10·8	6·0	5·5	−6·2	0·0	...	...	...	...	...	...	...	...	...	1·0	1·0	7·2	...	...	...
XII.	Sept. 15. 10 33	59·5	10·0	7·9	...	...	8·0	...	...	...	...	5·5	2·3	5·0	...	6·5	...	3·5	...	...	12·0	...	...	...
	18. 9 0	64·0	10·0	9·0	...	...	7·0	...	...	...	...	8·0	3·0	8·0	...	7·0	...	5·5	...	...	10·0	...	...	...
	19. 10 0	59·2	10·7	9·5	...	...	9·2	...	...	...	...	...	4·2	...	...	9·2	...	4·7	...	...	11·2	...	...	...
	19. 11 10	55·5	10·5	10·3	...	...	10·3	...	...	...	...	...	2·5	...	...	9·0	...	5·3	...	...	11·1	...	...	...
	19. 13 10	53·7	10·7	7·7	...	...	11·7	...	...	...	...	...	3·7	...	...	7·1	...	4·4	...	...	6·7	...	...	...
	20. 9 25	57·7	10·2	9·2	...	...	9·2	4·2	...	...	...	...	...	3·7	...	7·7	...	4·2	...	...	10·6	...	...	...
	21. 6 10	63·6	10·1	7·4	...	...	...	...	...	...	...	...	...	4·5	...	5·3	...	4·3	...	...	9·9	...	...	...
	22. 5 40	62·6	10·1	9·2	...	...	7·2	...	...	...	...	4·1	...	...	...	5·9	...	3·8	...	...	12·3	...	...	...
	22. 7 20	58·3	10·6	10·5	...	...	9·3	...	...	...	...	...	0·6	...	...	8·1	...	4·5	...	...	12·7	...	...	...
	22. 8 10	56·2	10·5	10·3	...	...	7·4	...	...	...	...	...	...	5·0	...	7·2	...	4·3	...	...	11·2	...	...	...
	22. 11 30	52·0	10·9	12·0	...	...	9·5	3·6	...	...	...	...	...	...	...	7·8	...	4·8	...	...	11·5	...	...	...
	22. 13 30	50·7	10·0	8·5	...	...	8·7	3·6	...	...	...	...	2·2	...	...	7·7	...	3·5	...	...	9·9	...	...	...
	23. 8 30	56·5	10·5	9·3	...	...	7·5	3·0	...	...	...	...	...	6·5	...	8·5	...	4·1	...	...	11·5	...	...	...
	23. 10 50	52·8	10·8	8·3	...	...	7·8	2·8	...	...	...	...	...	7·1	...	8·8	...	4·8	...	...	12·3	...	...	...
	23. 11 10	52·2	10·7	9·1	...	...	7·2	2·7	...	...	...	7·5	...	...	...	8·6	...	4·6	...	...	12·2	...	...	...
	26. 11 30	41·4	10·1	10·0	...	...	9·1	3·9	...	...	...	...	...	3·9	...	8·6	...	4·2	...	...	11·4	...	...	...
	27. 9 10	41·5	10·7	9·3	...	...	10·5	5·2	...	...	...	9·5	...	...	...	5·8	...	5·5	...	...	11·5	...	...	...
	27. 11 0	41·5	10·0	7·7	...	...	8·0	4·3	...	...	...	...	...	6·7	...	7·0	...	4·3	...	...	11·5	...	...	...
	Oct. 2. 7 25	50·0	10·5	9·5	...	...	9·0	4·3	...	...	...	...	2·5	...	...	9·0	...	4·5	...	...	11·8	...	...	...
	15. 15 20	39·8	10·0	9·4	...	...	10·8	5·3	...	...	...	...	...	...	...	9·4	...	...	...	3·6	...	...	...	...
	18. 7 40	38·0	10·0	8·0	13·3	...	7·6	2·4	...	...	...	4·6	4·0	4·3	...	6·5	...	...	...	2·8	1·7	10·0	...	...	...
	18. 9 30	36·8	10·8	8·8	12·8	10·8	9·8	3·8	...	...	...	6·8	6·1	5·9	...	7·8	...	...	...	4·8	3·4	13·8	...	...	...
	18. 14 30	30·6	10·8	9·8	14·6	14·7	10·9	5·1	...	...	...	4·4	3·6	5·1	...	8·1	...	...	...	4·1	3·3	12·8	...	...	...
	18. 18 0	30·0	10·4	8·9	12·0	12·0	12·8	5·2	...	...	...	4·8	2·9	5·8	...	8·9	...	...	...	4·5	4·0	13·2	...	...	...
	19. 4 30	43·5	10·3	7·0	13·5	11·6	7·0	2·1	...	...	...	7·9	0·7	2·8	...	5·0	...	...	...	2·3	1·6	11·5	...	...	...
	19. 8 10	35·9	10·7	10·7	15·9	15·9	11·4	4·9	−6·1	0·9	...	5·1	3·7	6·1	...	9·1	...	...	...	3·9	3·2	13·7	...	...	...
	21. 7 30	44·0	10·0	7·8	12·5	12·5	7·3	3·5	−4·0	−0·5	...	4·5	2·8	4·0	...	6·0	...	...	...	2·0	2·5	10·2	...	...	...
	25. 9 30	39·2	10·4	8·2	13·2	13·2	7·2	4·2	−6·8	−0·2	...	2·7	1·0	0·7	...	7·7	...	...	...	1·2	0·7	13·0	11·7	...	...
	25. 11 40	36·6	10·4	8·4	12·6	12·8	8·4	3·6	−5·7	0·9	...	5·1	2·6	3·6	...	7·5	...	...	...	1·8	1·4	10·8	11·0	...	...
	Nov. 7. 5 30	51·7	10·5	9·7	13·7	11·4	9·7	4·2	2·6	5·7	...	4·1	4·1	5·4	...	7·6	...	...	...	4·5	1·7	11·7	...	...	...
	12. 19 20	33·0	10·0	7·9	10·4	11·0	7·4	5·8	−6·2	1·2	...	...	...	...	...	...	...	...	...	2·7	2·3	9·0	...	...	...

Sept. 15, 11ʰ 0ᵐ; a thin cloud passing zenith. Sept. 18, 9ʰ 30ᵐ; the stars seem small. Sept. 19, 15ʰ 10ᵐ; the stars seem small, and they have a watery appearance. Sept. 20, 15ʰ 0ᵐ; deposition of moisture. Sept. 21, 6ʰ 55ᵐ; the clouds are confined to the zenith and around it. Sept. 21, 7ʰ 30ᵐ; the clouds are confined to the zenith and around it. Sept. 21, 18ʰ 20ᵐ; deposition of moisture. Sept. 24, 15ʰ 10ᵐ; the stars are dim and small. Sept. 28, 11ʰ 35ᵐ; a few clouds near S. horizon, and the stars are dim. Sept. 28, 13ʰ 25ᵐ; stars seem small and shine dimly. Oct. 19, 7ʰ 40ᵐ; dew just forming. Sept. 19, 10ʰ 0ᵐ; a few clouds. Sept. 19, 11ʰ 10ᵐ; stars seem small and watery. Sept. 19, 13ʰ 10ᵐ; stars seem small and watery. Sept. 23, 10ʰ 50ᵐ; the south portion of sky very clear. Sept. 23, 11ʰ 10ᵐ; the stars have become dim. Oct. 2, 7ʰ 25ᵐ; dew being deposited. Oct. 19, 8ʰ 10ᵐ; dew. Oct. 21, 7ʰ 30ᵐ; dew.

Oct. 19, 7ʰ 40ᵐ. At 7ʰ 0ᵐ a parcel of 10 grains of wool was placed on grass, and at this time it was found to weigh 11 grains. The temperature of the air at 7ʰ 40ᵐ was 3° less than it was 7ʰ 0ᵐ, and yet the differences between the readings of the several thermometers and that in air, is less by 2° or 3° than they were

Table (Continued).

Excess of the reading of the thermometer in air above that placed																												Clouds.		Wind.		
On coarse flax on grass.	On yellow cotton wool on grass.	On yellow cotton wool on raised board.	On blue cotton wool on grass.	On blue cotton wool on raised board.	On white wadding on grass.	On black wadding on grass.	On flannel on grass.	On flannel on raised board.	On raw silk on grass.	On raw silk on raised board.	On silk from cocoons.	On the raised board.	On raised board on fine sand.	On black-lead on raised board.	On charcoal on raised board.	On lamp black on raised board.	On whiting on raised board.	On chalk on raised board.	On tinfoil.	On lead.	On pastile.	On slate.	One-fourth of an inch above water.	On paper on raised board.	Modification.	Amount 0—16.	High or low.	Direction.	Strength 1—5.	Haze, fog, rain, or vapour.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°							
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...	...	...	...	...	...	...	...	...	...	...	...	...	...	8·0	8·7	...	...	...	...	...	...	...	...	...	Clear			c.	...		Mist
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12·5	...	10·5	...	10·5	...	...	...	8·5	...	9·1	10·2	7·5	5·2	8·0	7·4	...	8·5	...	...	...	...	...	3·5	...	Clear			c.			
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9·5	7·5	...	8·5	...	7·5	8·5	6·5	...	8·5	...	...	...	...	...	...	...	...	...	5·0	6·5	6·3	6·5	3·0	...	Clear			N.	3		
13·0	10·0	...	9·0	...	11·5	...	9·0	...	9·5	...	...	...	...	...	...	...	...	...	4·8	7·5	3·2	6·0	4·0	...	...	2					
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13·3	...	...	...	...	8·8	7·0	8·8	...	10·0	...	...	...	...	...	...	...	...	...	6·8	7·0	6·6	6·7	4·4	...	Clear			c.			
11·4	...	...	...	...	5·8	7·0	9·0	...	10·5	...	...	...	...	...	...	...	...	...	4·8	6·0	5·5	6·0	4·0	...	Clear			c.			
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13·6	...	12·5	...	12·6	...	...	...	12·4	...	13·6	9·9	8·4	5·6	9·4	9·6	...	11·6	...	...	...	...	...	...	...	Clear			L.			
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12·9	...	11·5	...	11·4	...	...	...	8·9	...	9·3	...	8·4	5·6	8·6	8·1	...	9·6	...	...	...	...	...	4·4	...	Clear						Haz.
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13·0	...	8·9	...	8·0	...	...	...	8·4	...	8·8	...	...	...	5·6	4·4	6·7	7·2	7·0	3·2	7·0	3·8	5·7	...	...	Clear			c.			

at the former time (see Table XIV.). It would seem from this circumstance that the heat evolved at the time of the deposit of dew was about 4°. At Oct. 19, 21^h the wool was found to weigh 21 grains, and the thickness of ice in the evaporator was found to be 0·5 inch.

Oct. 15, 4^h 35^m. At this time the thermometers were placed on their different substances, and large differences were almost immediately exhibited.

Oct. 19, 4^h 30^m. These observations were taken two hours before sun-set; during the whole of this day the temperature of vegetation in the shade was much below the temperature of the air; at 19^d 1^h the reading of a thermometer on grass was 39°·0, whilst that in air was 47°·2.

Oct. 25, 11^h 40^m. The water which was placed in the evaporating dish exposed to the whole sky is frozen, whilst that placed in a similar dish exposed to one-half of the sky only is not frozen.

Table (Continued).

Number of the Table.	1853. Astronomical day, hour and minute.	Reading of Therm. at the height of 4 feet above the ground when shaded from radiation.	Excess of the reading of the thermometer in air above that placed																								
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Mine inches above wood.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On garden mould.	On gravel.	On river sand.	On river sand on the raised board.	One inch high above grass.	Two inches high above grass.	Three inches high above grass.	Six inches high above grass.	Twelve inches high above grass.	On unwrought white cotton wool on grass.	On unwrought white cotton wool on raised board.	On raw wool on grass.	On raw wool on raised board.	On flax on raised board.
		h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
XIII.	Sept. 13. 15 15	49·8	11·3	10·3	...	...	11·8	...	...	...	...	...	2·8	8·8	8·3	10·3	5·3	...	...	...	12·3	...	...	...	...	...	...
	19. 7 20	62·4	11·4	10·4	...	...	...	...	...	...	...	...	6·3	6·4	...	8·2	...	6·0	...	...	11·7	...	...	...	...	...	...
	19. 9 20	58·7	11·2	9·2	...	...	9·2	...	...	...	...	...	6·7	3·2	5·7	...	8·7	...	3·7	...	...	10·5	...	...	...	...	...
	19. 9 40	59·3	11·3	9·8	...	...	9·3	...	...	...	...	...	7·3	4·3	6·3	...	9·3	...	4·8	...	...	12·3	...	...	...	...	...
	26. 9 10	47·2	11·7	10·7	...	...	10·7	6·2	...	...	...	...	...	...	5·7	...	7·2	...	5·7	...	...	13·7	...	...	...	...	...
	27. 6 40	44·5	11·7	8·3	...	...	10·5	5·3	...	...	...	...	...	...	3·7	...	9·3	...	5·4	...	...	12·7	...	...	...	...	...
	27. 7 30	44·0	11·7	8·7	...	...	10·1	5·0	...	...	...	...	2·7	...	...	...	7·8	...	7·8	...	...	13·0	...	...	...	...	...
	27. 13 0	40·3	11·1	9·1	...	...	8·8	3·8	...	...	...	...	4·8	...	...	...	8·1	...	4·3	...	...	13·3	...	...	...	...	...
	28. 17 25	38·1	11·7	10·1	...	...	10·1	4·6	...	...	...	...	...	7·3	...	...	8·1	...	5·2	...	...	12·6	...	...	...	...	...
	Oct. 18. 10 20	36·8	11·8	9·5	15·3	15·3	10·8	4·3	...	...	...	6·3	6·3	6·3	...	8·8	...	...	4·8	3·8	13·8	...	...	...	...	...	...
	18. 11 0	35·5	11·5	9·5	15·0	14·5	9·5	4·3	...	...	...	5·5	5·5	5·5	...	8·5	...	...	4·5	3·7	13·0	...	...	...	...	...	...
	18. 11 30	35·0	11·5	9·7	15·0	15·0	10·2	4·5	...	...	...	5·0	5·0	5·0	...	8·5	...	...	4·7	3·8	13·8	...	...	...	...	...	...
	19. 9 0	34·5	11·0	11·0	15·3	15·3	10·0	5·5	−5·5	−0·5	...	3·7	3·0	4·5	...	8·5	...	...	3·5	2·8	12·0	...	...	...	...	...	...
	25. 8 0	39·8	11·7	10·0	15·3	14·8	9·8	4·3	−5·7	−1·4	...	4·3	2·3	2·8	...	8·8	...	...	1·8	1·3	11·6	10·3	...	...	...	...	...
	26. 5 40	42·5	11·5	8·5	12·6	11·8	8·8	3·9	−3·5	−1·5	...	5·0	1·5	3·2	...	7·0	...	...	2·3	1·9	10·7	...	...	...	...	...	...
	29. 9 0	40·6	11·4	7·9	13·8	13·1	7·1	2·6	−2·4	−0·4	...	3·1	2·6	2·9	...	7·5	...	...	1·4	1·6	11·8	...	...	...	...	...	...
	Nov. 1. 4 30	43·0	11·1	9·0	14·5	13·5	8·5	5·0	−5·0	0·0	...	2·0	1·0	1·0	...	8·5	...	...	2·5	2·0	13·0	...	...	...	...	...	...
	1. 7 0	40·0	11·0	8·5	15·0	15·0	6·0	3·2	−5·0	−1·0	...	5·0	3·0	3·0	...	3·0	...	...	4·0	3·5	14·0	...	...	...	...	...	...
	4. 5 10	47·0	11·8	8·5	14·5	14·0	8·0	3·8	−3·0	1·5	...	5·0	0·0	2·8	...	7·5	...	...	2·2	1·8	12·8	...	...	...	...	...	...
	12. 6 0	37·5	11·0	11·5	13·7	13·5	9·5	4·0	−2·5	2·5	...	...	...	...	...	...	...	...	2·3	1·5	11·4	...	...	...	...	...	...
XIV.	Sept. 21. 8 30	41·0	12·2	9·5	...	...	7·0	...	...	...	...	4·8	...	...	...	8·0	...	4·5	...	...	14·8	...	...	...	...	...	...
	Oct. 16. 5 20	38·4	12·4	9·4	12·6	14·8	10·2	3·7	...	...	...	...	...	...	...	7·4	...	...	2·9	...	7·9	...	...	...	...	...	...
	18. 12 0	34·5	12·7	10·0	16·7	16·0	10·5	5·5	...	...	...	5·3	4·7	5·7	...	9·0	...	...	5·2	4·2	14·5	...	...	...	...	...	...
	19. 5 0	41·8	12·8	9·9	16·0	14·3	11·3	3·3	...	...	...	4·3	1·3	4·0	...	8·0	...	...	2·6	2·0	13·0	...	...	...	...	...	...
	19. 5 30	40·4	12·9	10·5	16·4	15·6	10·5	3·9	...	...	...	4·1	1·8	3·6	...	8·2	...	...	2·4	1·7	13·8	...	...	...	...	...	...
	Nov. 8. 19 0	31·3	12·3	9·3	16·3	13·3	11·3	5·8	−6·7	0·7	...	3·3	2·3	4·8	...	7·3	...	...	4·3	3·8	15·3	...	...	...	...	...	...
	12. 8 45	33·6	12·4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	12. 9 20	33·0	12·0	12·0	17·0	15·5	9·5	6·0	−5·0	4·0	...	...	...	...	...	...	...	...	2·5	2·2	12·0	...	...	...	...	...	13·2
	12. 10 10	32·3	12·5	12·1	17·3	15·1	10·3	6·3	−5·2	1·2	...	...	...	...	...	...	...	...	...	...	14·8	...	...	...	...	...	...
	13. 5 10	37·5	12·5	11·7	19·5	14·5	12·0	6·0	−1·8	1·7	...	...	...	...	...	...	...	...	...	...	14·0	...	...	...	...	...	...
	13. 5 30	37·6	12·6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	13. 7 0	36·0	12·5	11·0	11·4	12·0	11·0	5·4	−2·0	2·5	...	...	...	...	...	...	...	...	...	...	...	9·0	...	...	...	...	...
XV.	Sept. 13. 11 10	51·0	13·5	12·0	...	...	12·0	...	...	...	...	...	4·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	13. 12 0	50·5	13·5	12·5	...	...	13·5	...	...	...	...	...	3·5	7·5	7·5	12·0	7·5	...	...	...	...	9·5	...	...	...	...	...
	13. 14 30	50·0	13·0	12·0	...	...	11·5	...	...	...	...	...	3·0	8·5	7·5	10·5	5·2	...	...	...	11·5	10·0	...	...	...	...	...
	28. 15 15	40·2	13·2	10·3	...	...	11·2	5·2	...	...	...	6·0	...	...	...	10·2	...	6·7	...	...	13·9	...	...	...	...	...	...
	Oct. 18. 13 0	33·4	13·2	10·4	15·9	15·9	10·4	...	...	...	...	4·1	3·4	5·2	...	8·6	...	...	4·0	3·1	14·1	...	...	...	...	...	13·6
	18. 16 0	30·0	13·2	9·7	14·0	13·2	8·2	4·5	...	...	...	4·0	3·5	3·8	...	8·9	...	...	6·0	5·0	12·8	...	...	...	...	...	9·0
	19. 5 50	40·3	13·9	12·1	16·3	16·3	11·6	4·5	...	...	...	6·7	3·2	6·3	...	9·9	...	...	4·7	3·7	15·0	...	...	...	...	...	10·3
	25. 5 15	45·5	13·0	10·3	16·5	16·1	11·5	10·5	−4·5	0·0	...	2·3	0·1	2·1	...	9·3	...	...	5·3	4·7	13·4	14·5	...	...	...	...	13·3
	Nov. 12. 8 30	33·6	13·1	12·4	16·8	16·1	10·6	5·6	−4·9	0·6	...	...	...	...	...	...	...	...	3·3	2·5	15·1	...	...	...	...	...	...
XVI.	Sept. 13. 12 30	50·8	14·6	13·3	...	...	13·3	...	...	...	...	...	3·8	7·8	8·3	12·3	6·8	...	...	...	...	11·6	...	...	...	...	...
	13. 13 30	50·7	14·2	12·7	...	...	13·2	...	...	...	...	...	3·7	9·2	8·9	11·7	5·7	...	...	...	11·7	11·8	...	...	...	...	...
	Oct. 19. 6 15	40·3	14·1	11·5	16·3	16·8	12·8	6·2	...	...	...	7·5	4·8	7·1	...	10·3	...	...	4·5	3·8	15·3	...	...	...	...	...	11·5

Sept. 13, 15h 15m; the sky is cloudy to 30° high. Sept. 19, 9h 20m; clouds all round to 10° high. Sept. 19, 9h 40m; a few clouds to the north. Nov. 13, 5h 10m; dark clouds. Sept. 13, 11h 10m; great deposition of moisture. Sept. 13, 12h 0m; great deposition of moisture. Sept. 13, 14h 30m; great deposition of moisture. Sept. 28, 15h 15m; the stars small and dim. Sept. 13, 12h 30m; great deposition of moisture. Sept. 13, 13h 30m; great deposition of moisture.

Sept. 27, 13h 0m. Dew had been deposited previous to this observation: the thermometer placed on long grass was covered with hoar-frost, so much so that its stem had to be scraped before the reading could be taken: that placed on raw wool was similarly circumstanced, and it was firmly frozen to the wool.

Oct. 18, 12h 0m. The charcoal is white with hoar-frost: wool and flax are each a mass of ice, and the thermometers are firmly frozen to them. The thickness of ice in the evaporator was 0·82 inch.

Table (Continued).

Excess of the reading of the thermometer in air above that placed																										Clouds.		Wind.			
On coarse flax tow.	On yellow cotton wool on grass.	On yellow cotton wool on raised board.	On blue cotton wool on grass.	On blue cotton wool on raised board.	On white wadding on grass.	On black wadding on grass.	On fleazed on grass.	On fleazed on raised board.	On raw silk on grass.	On raw silk on raised board.	On silk from cocoons.	On the raised bed.	On sea-dust on the raised board.	On black bed on raised board.	On charcoal on raised board.	On lamp-black on raised board.	On whiting on raised board.	On chalk on raised board.	On tinfoil.	On lead.	On pastile.	On slate.	One-fourth of an inch above water.	On paper on raised board.	Modification.	Amount 0—16.	High or low ?	Direction.	Strength 0—6.	Haze, fog, mist, or vapour.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°						
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	3				
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.	...	Vap.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	1				
...	...	...	...	...	...	...	...	...	...	...	...	...	...	8·1	8·7	...	...	...	...	...	...	...	...	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	...	...	8·1	8·5	...	...	...	...	...	...	...	...	...	Clear			c.	...	Vap.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·7	9·0	...	...	...	...	...	...	...	...	...	Clear			c.	...	Vap.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	6·5	8·3	...	...	...	...	...	...	...	...	...	Clear					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·7	9·2	...	...	...	...	...	...	...	...	...	Nearly clear					
11·8	...	11·0	...	11·1	...	...	...	8·8	...	10·8	11·6	8·8	6·8	7·6	8·8	...	7·8	...	...	...	...	...	...	...	Clear					Haze
13·5	...	11·0	...	11·5	...	...	...	8·5	...	12·0	12·0	9·5	5·5	7·5	8·6	...	7·5	...	...	...	...	...	...	...	Clear					Haze
13·8	...	10·5	...	12·7	...	...	...	9·5	...	12·5	11·5	9·2	6·5	9·0	8·8	...	9·2	...	...	...	...	...	...	...	Clear					
14·0	...	12·5	...	12·3	...	...	...	9·5	...	12·5	10·5	7·3	5·0	7·3	7·5	...	11·0	...	...	...	...	...	...	...	Clear			c.	...	Haze
13·8	...	11·6	...	11·6	...	...	...	11·3	...	10·7	...	7·8	6·8	9·0	7·9	...	8·8	...	...	...	...	4·8	...	...	Clear					
12·9	...	9·7	...	8·9	...	...	...	7·7	...	7·5	...	6·0	5·7	6·9	4·5	...	6·5	...	...	...	...	3·7	7·5	...	.....	1				
11·6	...	4·6	...	4·6	...	...	...	2·6	...	5·6	...	6·0	...	...	3·8	...	5·4	...	...	...	...	2·4	...	...	Clear					
13·0	...	7·8	...	9·2	...	...	...	9·0	...	9·0	...	5·2	...	8·5	7·0	...	7·0	7·0	8·0	...	...	3·0	...	...	Clear					
14·0	...	5·0	...	5·0	...	...	...	6·0	...	6·0	...	6·0	...	6·2	6·0	...	7·5	7·5	7·0	...	...	5·0	...	...	Clear			c.	...	Fog.
13·0	...	6·5	...	8·0	...	...	8·6	6·5	12·5	...	...	9·5	...	6·2	5·8	...	6·4	6·0	...	...	5·5	5·5	2·8	...	Clear					
14·9	...	...	...	...	7·5	7·0	...	...	...	...	...	...	...	6·0	6·2	7·3	6·5	7·1	5·7	...	5·9	6·3	...	...	Clear					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	3·0	3·5	...	...	...	...	...	...	...	...	...	Clear					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.		
14·2	...	11·7	...	12·7	...	...	...	11·7	...	13·3	10·5	8·0	8·0	8·3	10·0	...	9·3	...	...	...	...	...	...	...	Clear			c.	...	Haze
15·3	...	9·6	...	9·6	...	...	...	9·6	...	12·6	8·6	7·0	6·6	7·0	7·6	...	7·8	...	...	...	...	...	...	...	Clear					
16·4	...	10·4	...	10·8	12·8	13·3	9·3	9·3	...	11·9	9·9	7·2	7·2	6·4	7·6	...	7·2	...	...	...	...	...	...	...	Clear			c.		
13·3	10·3	...	12·1	...	...	...	...	9·8	...	...	...	...	...	...	...	...	...	...	6·3	9·3	5·8	7·3	2·8	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	...	...	10·4	7·8	11·5	11·2	10·4	...	...	...	...	...	...	Clear			c.		
16·0	...	...	...	...	15·5	12·8	...	...	13·0	...	...	...	...	9·8	7·0	9·8	9·5	9·8	5·0	9·0	5·0	8·0	...	...	Clear			c.		
15·8	...	...	...	...	12·8	11·3	12·8	...	12·3	...	...	...	...	10·1	6·8	10·5	10·5	10·3	4·8	9·1	5·1	7·8	...	...	Clear			c.		
14·5	...	...	...	...	12·5	13·5	12·5	...	10·5	...	...	...	...	8·5	7·5	10·5	7·5	9·5	5·5	9·3	6·0	9·5	...	...	.....	3				
...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·6	7·1	9·4	7·1	8·7	...	...	...	...	...	...	Clear					
12·0	...	...	...	...	9·4	9·0	10·5	...	9·2	...	...	...	...	8·0	7·0	10·5	9·0	9·5	5·0	8·2	5·2	7·0	...	...	Clear					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	8·4	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	7·2	...	...	...	...	...	...	...	...	...	...	...	...	.....	1				
...	...	...	...	...	...	...	...	...	...	...	...	...	...	9·5	9·2	...	...	...	...	...	...	...	...	...	Clear			c.		
...	13·4	...	14·4	...	14·9	...	...	...	15·3	12·2	10·4	7·2	9·9	10·9	...	10·2	...	...	...	...	...	...	...	...	Clear			c.		
...	11·0	...	12·0	...	11·0	...	...	...	12·2	7·6	9·3	4·8	8·5	11·0	...	9·8	...	...	...	...	...	...	...	...	Clear			c.		
...	16·5	...	12·2	...	12·5	...	...	...	13·3	11·5	9·8	8·1	7·5	9·7	...	8·3	...	...	...	...	...	...	...	...	Clear			c.		
...	15·8	...	14·5	...	14·5	14·6	12·6	12·6	14·6	14·3	11·3	8·5	...	10·5	10·3	...	10·0	...	...	...	...	...	6·0	...	Clear			c.		
...	18·5	...	...	...	...	...	...	...	...	...	...	...	...	9·6	7·1	10·6	9·6	...	5·1	8·4	3·5	7·1	...	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	8·3	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.		
...	...	...	...	...	...	...	...	...	...	...	...	8·2	...	...	...	...	...	...	...	...	...	...	...	...	Clear			c.		
...	16·5	...	13·8	...	14·1	...	...	...	...	16·1	12·1	10·1	9·3	10·3	11·5	...	10·1	...	...	...	...	...	...	...	Clear			c.		

Nov. 1, 4h 25. An inch of rain had fallen previously, and at this time the sky became suddenly clear; dry substances were placed, and immediately the above large differences were exhibited.

Nov. 12, 8h 30m. The reading of the thermometer on coarse flax was 18°·5 below that in air (see Table XV.); and Nov. 13, at 5h 10m, the difference between the readings of the thermometer in air and that on raw wool was as large as 19°·5 (see Table XIV.). These differences were greater than any hitherto met with by any person, and especial care was taken so as to be certain of their correctness.

Excess of the reading of a thermometer placed in air at the height of 4 feet, protected from the effects of radiation, above the readings of thermometers placed on different substances fully exposed to the

Number of the Tables.	1843. Day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																								
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On long grass covered by							On garden mould.	Six inches high above grass.	One foot high above grass.	Two feet high above grass.	On lambs' wool on grass.					
												White raw wool.	Flax.	White tin.	White tin, one inch high.	Blackened tin.	Glass.	Glass one inch high.					Jet black.	White.	Green.	Light blue.	Dark blue.	Orange.
	h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
XVII.	Dec. 13. 17 15	41·5	0·5	0·5	1·5	1·5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
XVIII.	Nov. 27. 19 30	48·3	2·8	2·7	3·5	2·2	2·9	0·3	1·6	2·1	...	...	...	...	...	...	...	...	1·8	...	−0·2	−0·4	...	...	...	...	...
	29. 21 0	35·0	2·5	3·8	2·0	1·5	2·0	−0·5	−5·0	−2·0	...	...	...	...	...	...	...	...	...	...	−0·2	−0·5	...	...	...	...	...
	Dec. 13. 17 0	41·5	2·5	2·5	2·5	2·5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
XIX.	Nov. 20. 5 30	43·2	3·4	3·7	...	...	3·5	−0·8	−3·6	3·2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	20. 8 0	43·7	3·9	5·4	5·7	5·4	5·2	1·7	−0·5	3·7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	29. 18 0	33·7	3·9	3·9	5·7	5·7	3·9	1·7	−6·3	−2·3	...	...	...	...	...	...	...	...	...	...	0·5	0·2	...	...	...	...	...
XX.	Nov. 15. 5 10	37·9	4·0	4·0	4·4	4·0	4·2	1·8	−3·0	1·9	...	...	...	...	...	...	...	...	...	1·0	0·2	...	...	...	...	...	...
	27. 4 10	51·8	4·8	4·3	6·8	5·8	4·8	0·8	−2·8	3·0	0·0	...	...	...	...	...	...	...	3·3	...	−0·4	−0·4	3·4	2·9	3·3	3·0	3·0	3·0
	27. 11 30	48·5	4·7	4·5	5·9	4·2	4·7	1·3	1·0	1·5	...	...	...	...	...	...	...	...	2·5	...	−0·3	−0·6	...	...	...	...	...
	27. 13 30	47·0	4·0	4·0	5·5	3·4	4·7	0·6	0·6	1·0	...	...	...	...	...	...	...	...	3·0	...	−0·2	−0·5	...	...	...	...	...
	29. 19 0	34·5	4·7	4·7	6·7	5·7	4·0	2·4	−5·0	−1·0	...	...	...	...	...	...	...	...	...	...	1·4	0·7	...	...	...	...	...
	Dec. 6. 11 0	41·2	4·8	5·2	6·2	5·2	5·2	1·4	−0·8	3·2	−0·8	...	...	2·2	2·2	...	2·2	4·7	...	...	−0·2	0·0	...	...	...	...	...
	13. 18 0	40·0	4·5	4·5	4·5	4·5	3·0	1·8	−1·0	1·8	−0·5	1·5	1·5	2·5	2·5	4·5	5·0	2·5	...	...	−0·5	−0·5	...	...	...	...	...
	15. 3 45	48·7	4·7	4·7	3·7	4·6	4·5	0·6	2·7	3·4	3·3	...	...	...	...	3·4	3·9	1·5	...	...	−0·1	−0·3	...	...	...	...	...
	15. 19 30	43·0	4·0	5·0	4·0	5·0	5·0	1·2	1·2	3·0	−1·0	...	...	...	...	...	3·0	1·5	...	...	0·8	0·8	...	...	...	...	...
XXI.	Nov. 15. 4 15	38·0	5·9	5·0	6·5	5·7	7·0	2·5	−2·7	0·7	...	...	...	...	...	...	...	...	...	3·2	0·8	...	...	...	...	...	...
	18. 9 30	40·1	5·1	...	4·3	5·3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	18. 10 0	40·3	5·3	5·3	4·3	5·5	5·3	1·5	−0·7	2·1	...	...	...	...	...	...	...	...	...	0·3	0·1	...	...	...	...	...	...
	20. 9 30	42·0	5·5	4·5	5·2	6·0	5·6	1·0	...	3·7	...	...	...	...	...	...	...	...	...	−0·2	...	...	...	...	...	...	...
	23. 11 0	37·8	5·0	5·0	6·3	6·8	6·3	1·3	−3·2	−0·2	...	...	...	...	...	...	...	...	3·3	...	−0·2	−0·2	4·7	4·2	4·3	4·3	3·5	4·0
	28. 4 10	48·5	5·9	5·2	6·0	5·6	5·4	0·9	1·3	2·3	...	...	...	...	...	...	...	...	3·0	...	0·0	−0·3	1·9	2·0	2·4	3·1	2·6	2·1
	28. 5 0	47·4	5·2	4·5	5·4	4·3	4·7	0·7	0·7	1·8	...	...	...	...	...	...	...	...	2·8	...	−0·4	−0·6	3·1	3·3	2·8	3·3	3·1	2·3
	29. 17 0	33·8	5·8	4·3	6·6	5·8	3·8	0·8	−7·2	−2·2	...	...	...	...	...	...	...	...	...	...	−0·4	−0·9	...	...	...	...	...
	Dec. 5. 21 0	41·5	5·3	5·0	5·5	5·0	4·7	1·5	−0·7	1·5	0·5	...	...	3·8	3·7	...	2·7	2·3	...	...	0·3	0·0	...	...	...	...	...
	6. 3 45	46·2	5·8	6·2	6·9	6·1	5·5	1·2	0·4	3·0	2·1	...	...	3·2	3·5	...	4·4	3·2	...	...	−0·7	−0·5	...	...	...	...	...
	14. 3 0	45·7	5·9	5·2	5·2	4·5	6·7	0·5	1·7	3·7	2·9	3·7	3·7	2·9	2·9	4·9	4·5	2·5	...	...	−0·1	−0·3	...	...	...	...	...
	14. 4 0	44·7	5·7	5·8	5·8	5·5	5·7	1·2	1·7	2·9	2·5	3·7	3·7	4·2	2·5	4·7	3·8	1·7	...	...	−0·3	−0·3	...	...	...	...	...
	15. 5 0	47·6	5·6	5·3	5·4	5·9	5·6	1·4	2·6	4·1	2·6	...	...	...	...	...	4·2	...	...	...	−0·2	−0·4	...	...	...	...	...
	15. 18 0	43·2	5·4	5·2	4·6	4·7	4·4	1·4	1·2	2·9	1·2	...	...	...	...	...	3·6	...	...	...	−0·6	−0·8	...	...	...	...	...
	15. 21 0	45·0	5·0	4·5	4·3	5·8	5·0	1·8	2·7	3·0	2·2	2·3	...	...	...	...	3·0	...	...	...	−0·3	0·0	...	...	...	...	...
XXII.	Nov. 16. 13 5	31·0	6·3	6·0	5·8	6·2	4·5	2·8	−4·0	1·0	...	...	...	...	...	...	...	...	...	1·0	1·0	...	2·8	3·5	4·1	3·5	2·4	3·4
	18. 5 30	41·6	6·8	...	5·8	8·1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	23. 14 0	35·7	6·7	6·7	9·5	9·5	8·7	...	−3·8	−1·1	...	...	...	...	...	...	...	...	4·5	...	1·2	1·2	...	...	...	...	...
	23. 15 0	35·0	6·5	6·8	10·0	9·8	9·0	2·7	−4·0	−2·0	...	...	...	...	...	...	...	...	4·0	...	1·2	1·0	...	...	...	...	...
	24. 4 0	40·7	6·7	6·2	6·7	6·7	6·7	3·0	−2·3	−0·3	...	...	...	...	...	...	...	...	4·2	...	1·9	1·7	...	...	...	...	...
	28. 3 45	49·1	6·1	4·1	5·6	5·5	5·6	2·7	1·7	1·6	...	...	...	...	...	...	...	...	2·1	...	0·1	−0·1	...	...	...	...	...
	28. 21 0	44·8	6·6	7·0	7·8	6·6	6·3	0·7	1·8	3·6	...	...	...	...	...	...	...	...	4·8	...	1·1	0·8	...	...	...	...	...
	Dec. 5. 17 30	40·6	6·6	5·6	6·1	6·3	6·1	2·0	−2·6	−0·6	...	...	...	...	...	...	4·1	...	...	...	−0·1	−0·3	...	...	...	...	...
	5. 19 30	40·5	6·7	5·5	6·5	7·0	6·5	2·1	−2·2	0·9	...	...	...	...	...	...	4·2	...	...	...	0·0	−0·3	...	...	...	...	...
	6. 7 10	42·4	6·9	6·4	6·4	6·4	5·4	2·3	−0·6	1·6	0·4	...	...	...	...	...	3·8	...	...	...	−0·6	−1·0	...	...	...	...	...
	6. 14 0	41·0	6·0	6·0	5·7	5·0	6·0	1·4	−0·2	2·0	−0·5	...	...	2·0	...	...	4·8	4·0	...	...	−0·2	−0·2	...	...	...	...	...
	11. 6 30	39·0	6·8	6·0	7·0	7·2	5·0	1·8	−2·5	0·0	−2·5	4·0	5·0	3·5	3·0	5·5	4·4	3·0	...	...	1·2	2·0	...	...	...	...	...
	11. 9 30	36·6	6·4	5·8	6·1	7·6	6·1	2·3	−3·3	−0·1	−3·3	3·1	3·6	2·6	3·1	4·1	2·8	1·3	...	...	0·6	0·4	...	...	...	...	...
	Dec. 13. 17 5	41·5	6·5	5·5	6·5	6·5	...	2·3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	14. 5 0	44·4	6·2	5·9	5·2	5·2	5·4	1·2	1·9	3·2	2·2	3·4	3·4	2·4	2·4	4·4	4·6	1·9	...	...	−0·7	−0·6	...	...	...	...	...

Dec. 6, 11h 0m. Dew is abundant, yet the temperature of the dew-point is from 4° to 5° below that of the air, being about the same as that of the metals which are thickly covered with dew (see Table XX.).

Dec. 13, 12h 0m. The sky was overcast with a high and very black cirrostratus. The temperature of the air was 45°; the readings of the thermometers at both

sky, arranged according to the difference of the readings of the one on Long Grass and that in Air, from observations between 1843, Nov. 16, and the end of the year 1843.

Excess of the reading of the thermometer in air above that placed																								Clouds.		Wind.		
On lambs' wool on grass.			On copper on grass.	On lead on grass.	On iron on grass.	On zinc on grass.			On tin.			On tin-foil.	On pasteboard.	On slate.	On stone.			On brick.	On glass on grass.	On glass one inch high.	On unwrought white cotton wool on grass.	On the raised board.	One-fourth of an inch above water	On coarse flax on grass.	Modification.	Amount 0–10.	High or low.	Direction.	Strength 0–6.	Haze, fog, mist, or vapour.
Yellow.	Crimson.	Scarlet.				Thick.	Of moderate thickness.	Thin.	White on grass.	White one inch high.	Blackened on grass.				Firestone.	Purbeck.	Portland.												
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					
...	...	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Cirrostratus	10			
...	...	...	2·5	2·3	1·2	...	...	...	2·0	...	...	...	1·8	2·4	1·6	...	...	0·7	...	1·0	...	...	0·7	... Cirrostratus	10	...	2	
...	...	...	0 0	2 0	–0·6	...	...	0·1	0·0	...	1·4	...	1·5	1·6	...	...	...	1·6										
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Cirrostratus	10			
...	...	...	4·2	...	2·5	...	...	...	2·5	2·7	4·5	...	...	...	1·7	...	...	1·7	3·9	3·8	...	...	...	... Cirrostratus	10			
...	...	...	...	4·0	...	...	...	...	...	...	...	2·7	2·9	4·7	...	...	...	...	...	...	...	...	...	... Cirrostratus	10			
...	...	...	...	5·7	...	3·7	3·9	2·5	...	...	...	...	2·5	3·9	...	...	...	...	...	...	...	...	1·5	... Cirrostratus	10			
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4·0	...	...	Cirrostratus	10			
3·5	3·0	2·0	3·3	2·7	2·6	...	...	...	2·8	...	...	...	2·0	2·0	1·8	...	...	1·3	...	...	...	...	4·5	.....	1	w.	1	
...	...	...	3·5	2·3	2·9	...	...	...	4·5	...	...	...	2·8	3·0	1·9	...	...	1·7	...	...	...	...	2·8	... Clear	.....	w.	1	
...	...	...	3·0	3·2	2·5	...	...	...	3·5	...	...	...	2·7	3·2	1·5	...	...	1·0	...	...	...	...	0·7	... Clear	.....	w.	1	
...	...	...	3·3	2·1	4·0	4·5	4·7	4·0	3·2	4·0	5·0	...	2·0	2·2	2·5	...	...	3·0	5·7	6·0	...	...	1·0	... Cirrostratus	10	w.	1	
...	...	...	4·7	4·5	3·7	4·2	3·2	3·2	5·0	3·5	4·7	...	4·0	4·0	4·7	...	...	3·0	2·7	3·0	...	...	...	... Wh. fleecy cl	7	w.	L.	
...	...	...	4·0	4·4	3·8	3·2	3·5	3·5	3·0	3·0	4·5	...	3·7	5·2	3·0	2·5	2·0	...	4·5	3·0	...	...	1·7	... Cirrostratus	10			
...	...	...	3·2	4·0	3·2	3·1	3·5	3·2	...	...	3·9	...	...	...	1·9	1·7	1·7	2·5	4·2	2·3	...	...	...	... Clear				
...	...	...	...	2·6	...	...	4·2	2·2	...	...	3·0	...	...	...	...	...	...	...	2·6	1·4	...	...	...	... Clear				
...	...	...	...	4·0	...	...	...	...	...	...	...	3·2	2·7	2·8	...	...	...	...	...	...	5·7	...	...	Cirrostratus	10			
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Clear	.....		2	
...	...	...	...	3·5	...	...	...	...	...	...	...	...	3·1	3·8	...	...	...	...	...	...	...	3·5	2·5	Clear				
...	...	...	...	3·5	...	...	...	...	...	...	...	...	3·2	3·8	...	...	...	...	...	...	...	...	...	.....				
4·7	3·7	3·4	3·3	2·8	3·8	...	...	...	...	...	...	...	2·8	3·8	3·0	...	...	2·8	...	...	...	...	1·8	.....	5	w.	L.	Vap.
2·9	2·3	2·3	4·3	2 8	3·3	...	...	...	3·3	...	...	...	3·2	3·4	2 3	...	...	1·9	...	...	...	...	1·6	... Cirrus	5	w.	1	
4·1	2·3	3·3	3·2	2·2	2·4	...	...	...	2·9	...	...	...	2·6	2·7	2·1	...	...	1·6	...	...	...	...	1·9	... Cirrus	5	w.	1	
...	...	...	4·3	4·0	2·6	3·8	3·9	1·8	2·6	2·3	8·3	...	2·8	3·3	1·8	...	...	1·8	4·6	2·8	...	...	1·0	.....				
...	...	...	4·7	4·7	3·5	4·3	4·7	4·5	5·0	4·3	4·7	...	3·3	4·3	2·7	...	...	...	4·3	4·0	...	...	...	... Clear				
...	...	...	4·4	3·4	3·5	4·2	4·1	4·6	4·4	4·2	4·8	...	3·2	3·2	3·0	...	...	2·9	5·1	3·2	...	...	2·2	... Clear				
...	...	...	4·5	2·9	3·5	3·7	3·7	3·9	3·5	3·7	4·2	...	...	...	2·2	2·4	1·9	...	4·9	3·5	...	...	...	Thin clouds	8	H.		
...	...	...	4·9	1·4	3·5	4·5	4·5	4·5	3·5	2·8	4·2	...	...	...	2·5	2·6	2·5	...	4·9	3·2	...	...	...	.....	3	w.	½	
...	...	...	3·9	3·8	3·8	3·8	3·8	4·0	...	...	4·6	...	...	...	2·9	2·6	2·9	2·8	3·8	2·5	...	...	...	Clear				
...	...	...	3·9	...	3·9	...	...	...	...	...	3·4	...	...	...	2·0	...	...	...	4·1	...	...	...	...	Clear				
...	...	...	3·5	3·5	3·8	...	3·5	3·3	4·0	3·5	4·2	...	...	...	3·0	3·8	2·8	...	4·2	2·5	...	...	...	Clear				
...	...	...	...	3·8	...	...	...	...	...	...	...	...	2·3	3·8	...	...	...	...	...	...	6·0	...	6·0	.....	10			
4·6	3·3	3·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Nearly clear				
...	...	...	4·7	3·5	3·8	...	...	...	4·0	...	...	...	4·5	4·2	3·7	...	...	2·7	...	...	...	...	2·7	...	2	c.	...	Vap.
...	...	...	4·5	3·3	3·8	...	...	...	3·1	...	...	...	3·5	4·0	3·8	...	...	2·9	...	...	...	...	2·0	...				
...	...	...	6·5	4·9	4·2	...	...	...	3·7	...	...	...	2·9	3·9	1·5	...	...	2·2	...	...	...	...	2·2	.....	5	s.e.	L.	
...	...	...	4·6	3·4	3·9	...	...	...	3·5	...	...	...	3·6	3·8	2·3	...	...	2·3	...	...	...	...	2·1	... Cirrus	2			
...	...	...	5·0	5·6	4·6	...	...	...	6·0	...	...	...	4·7	5·6	4·8	...	...	1·8	...	...	...	...	1·8	.....				
...	...	...	6·1	5·6	4·6	5·3	5·3	5·6	5·4	...	5·5	...	2·6	4·7	...	...	...	...	5·6	...	...	...	...	Clear				
...	...	...	6·3	5·6	4·7	5·8	5·5	5·8	5·5	...	5·5	...	2·4	4·7	...	...	...	...	5·5	...	...	...	...	Clear				
...	...	...	...	4·2	4·4	...	...	...	4·4	...	3·6	...	4·4	4·4	...	...	...	...	5·4	...	...	...	2·1	... Clear				
...	...	...	5·0	4·5	4·2	4·8	4·5	5·0	4·0	3·5	4·8	...	4·0	4·0	3·8	...	...	3·8	4·5	3·0	...	...	1·5	... Wh. fleecy cl	7	w.	L.	
...	...	...	4·8	4·2	4·0	4·8	4·8	4·8	3·8	4·0	5·8	...	...	...	3·0	4·0	3·0	3·8	5·5	5·0	...	...	1·0	.....				
...	...	...	4·6	4·6	3·4	5·3	5·2	5·6	3·6	3·6	4·3	...	...	...	2·3	2·6	1·9	1·8	4·6	3·5	...	...	0·6	.....				
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	1			
...	...	...	5·2	4·1	3·2	4·2	4·2	4·2	3·4	3·2	4·4	...	...	...	2·6	2·9	2·2	...	4·6	2·9	...	...	...	Clear	.....		½	

one and two feet high were 45°; the readings of those placed on long grass, short grass, raw wool and flax were all 41°·5, and those on all metals read 43°; the temperature on the surface of the ground was 42°·5, and the air was in gentle motion from the west; yet there was a small portion of dew on most substances, which seems anomalous as the temperature of the dew-point was 40°.

Table (Continued).

Number of the Table.	1843. Day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air above that placed																						
			On long grass.	On short grass.	On raw wool on grass.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of grass under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On long grass covered by										On lambs' wool on grass.				
												White raw wool.	Flax.	White tin.	White tin one inch high.	Blackened tin.	Glass.	Glass one inch high.	On garden mould.	Six inches high above grass.	One foot high above grass.	Two feet high above grass.	Jet black.	White.	Green.	Light blue.	Dark blue.	Orange.
			°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
XXIII.	Nov. 18. 7 30	39·8	7·3	6·8	8·8	8·8	7·0	1·8	−1·5	2·2	...	...	...	...	...	...	...	...	0·6	1·0	...	3·6	4·0	3·8	5·1	3·6	3·8
	23. 12 0	36·5	7·0	6·3	8·0	8·5	8·0	2·5	−3·5	−1·0	...	...	...	...	...	...	...	4·0	...	0·0	0·0	...	...	...	...	...	...
	29. 4 40	46·7	7·7	6·7	9·7	8·7	6·1	2·7	1·2	2·9	...	...	...	...	...	...	...	...	...	1·7	1·2	...	...	...	...	...	...
	29. 11 0	42·8	7·8	7·8	7·8	8·8	7·8	2·3	3·8	−0·2	...	...	...	...	...	...	...	...	...	1·3	1·3	...	...	...	...	...	...
	Dec. 2. 3 40	40·8	7·0	5·9	5·8	6·9	6·8	1·6	−4·0	3·7	2·4	...	...	2·5	2·3	...	3·4	2·8	...	0·3	0·2	...	...	...	...	...	...
	2. 4 30	39·5	7·9	6·5	9·0	9·3	6·7	2·0	−4·3	1·2	2·2	...	...	2·2	2·5	...	4·2	3·0	...	−0·3	−0·5	...	...	...	...	...	...
	6. 4 15	45·8	7·6	6·8	8·4	8·8	6·3	2·2	0·4	3·0	2·5	...	...	3·3	3·3	...	4·8	4·0	...	0·8	0·5	...	...	...	...	...	...
	7. 19 0	49·0	7·0	6·0	9·0	6·5	5·0	2·0	2·7	4·0	2·2	...	...	...	...	...	3·0	...	...	−0·3	−0·3	...	...	...	...	...	...
	7. 21 0	45·0	7·3	5·8	7·8	6·6	6·0	1·8	4·6	5·6	3·8	...	...	...	4·8	...	2·8	1·8	...	1·6	0·8	...	...	...	...	...	...
	8. 7 30	45·0	7·8	8·0	10·0	9·0	5·4	3·0	1·8	6·0	3·0	...	...	5·2	6·2	...	...	4·8	...	1·2	0·2	...	...	...	...	...	...
	15. 15 30	46·5	7·3	6·5	6·0	7·3	5·9	2·1	3·2	4·3	2·5	6·0	...	...	...	...	4·7	3·2	...	0·5	−0·3	...	...	...	...	...	...
	17. 4 0	46·0	7·0	7·0	7·9	6·0	6·5	1·0	1·2	4·2	3·2	7·9	3·0	6·0	5·8	6·0	4·2	4·0	...	−0·2	0·0	...	...	...	...	...	...
XXIV.	Nov. 16. 11 25	32·2	8·0	6·8	10·8	7·2	4·7	1·5	−3·2	2·4	...	...	...	...	...	...	...	...	0·6	0·2	...	5·2	7·2	7·2	6·2	7·2	6·0
	18. 4 30	42·5	8·3	7·3	9·5	8·5	10·5	2·9	−1·0	2·0	...	...	...	...	...	...	...	...	0·5	−0·3	...	4·0	5·0	3·4	5·0	4·7	4·5
	18. 5 0	41·5	8·5	7·5	8·8	9·5	7·5	2·0	−1·2	4·5	...	...	...	...	...	...	...	...	0·3	0·3	...	4·3	5·2	4·4	4·7	4·0	5·0
	28. 16 0	49·0	8·8	7·8	9·4	7·5	7·4	2·8	−2·7	4·0	...	...	...	...	...	...	...	5·5	...	2·0	1·0	...	...	...	...	...	...
	29. 4 15	46·6	8·6	8·6	9·6	9·8	7·6	3·6	0·5	3·6	...	...	...	...	...	...	...	...	...	2·1	1·6	...	...	...	...	...	...
	29. 5 10	45·3	8·3	7·1	8·3	6·8	7·0	2·3	−0·2	3·6	...	...	...	...	...	...	...	...	...	0·6	0·3	...	...	...	...	...	...
	29. 9 10	42·5	8·5	8·5	9·9	11·0	7·5	3·5	0·2	4·7	...	...	...	...	...	...	...	...	...	1·5	0·9	...	...	...	...	...	...
	Dec. 1. 9 5	42·3	8·1	7·3	5·3	7·2	8·3	4·3	...	1·3	...	...	...	...	...	...	...	...	...	...	1·1	...	...	...	...	...	...
	5. 16 15	42·7	8·0	7·7	7·7	7·7	7·3	3·7	−1·3	2·0	...	...	...	...	...	5·6	...	...	...	0·9	0·4	...	...	...	...	...	...
	6. 4 45	45·2	8·2	7·2	9·7	8·6	6·5	3·2	0·4	3·2	...	...	...	3·0	4·8	...	5·2	4·8	...	0·5	0·2	...	...	...	...	...	...
	6. 5 10	44·5	8·0	7·0	8·9	7·9	6·6	2·8	...	...	2·4	...	...	...	...	...	...	...	...	1·0	0·7	...	...	...	...	...	...
	8. 13 35	38·1	8·3	4·1	9·6	6·9	6·6	4·1	−3·5	2·3	2·1	...	...	...	...	...	...	...	...	...	2·1	...	...	...	...	...	...
	11. 3 55	42·8	8·9	7·8	9·7	10·2	8·8	...	−2·7	3·3	−0·4	...	...	...	...	...	...	...	...	1·0	0·8	...	...	...	...	...	...
	17. 13 35	38·6	8·4	6·3	6·6	6·4	4·6	2·0	−2·2	−0·4	2·9	...	...	...	1·6	5·1	...	...	...	...	1·4	...	...	...	...	...	...
XXV.	Nov. 29. 7 30	43·7	9·7	8·7	10·7	11·7	9·2	5·2	−0·3	3·7	...	...	...	...	...	...	...	...	...	2·5	2·2	...	...	...	...	...	...
	29. 13 45	41·2	9·5	8·2	9·0	6·7	8·2	3·7	−0·8	3·0	...	...	...	...	...	...	...	...	...	2·0	2·0	...	...	...	...	...	...
	Dec. 8. 5 0	46·3	9·3	9·3	13·5	13·3	7·3	3·3	1·3	4·3	1·5	...	...	...	...	...	5·3	...	...	1·5	1·1	...	...	...	...	...	...
	8. 12 15	40·5	9·3	6·0	9·5	8·7	7·0	3·3	−0·5	2·5	1·3	...	...	...	...	...	4·3	...	...	...	2·5	...	...	...	...	...	...
	11. 4 30	41·2	9·7	8·7	10·7	11·2	9·2	2·4	−2·8	0·7	−1·6	5·2	4·2	4·2	4·2	8·2	5·4	5·0	...	1·0	0·7	...	...	...	...	...	...
	11. 5 30	40·1	9·3	9·1	9·1	9·3	9·1	3·3	−2·2	0·4	−1·1	...	...	...	...	...	5·5	3·5	...	...	0·6	0·4	...	...	...	...	...
XXVI.	Nov. 16. 7 10	38·5	10·8	10·8	18·5	13·5	11·5	7·0	−0·5	3·5	...	...	...	...	...	...	...	...	6·5	5·4	4·7	...	11·0	13·5	12·3	13·7	12·5	12·7
	18. 4 35	42·5	10·5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9·5	11·5	10·6	11·6	12·0	11·0
	28. 18 50	45·5	10·5	9·3	10·5	7·7	8·7	3·8	1·5	6·5	...	...	...	...	...	...	...	...	...	1·9	1·2	...	...	...	...	...	...
	29. 12 30	41·5	10·3	7·6	9·9	10·0	9·5	3·5	−0·5	2·6	...	...	...	...	...	...	...	...	...	1·5	1·0	...	...	...	...	...	...
	29. 15 0	37·5	10·5	7·5	14·0	13·0	10·0	3·3	−3·5	2·0	...	...	...	...	...	...	...	...	...	1·5	1·2	...	...	...	...	...	...
	Dec. 8. 4 10	48·0	10·0	10·7	12·2	11·8	...	...	1·8	...	...	...	...	...	...	8·0	...	...	...	1·7	2·0	...	...	...	...	...	...
	8. 9 30	43·5	10·3	8·5	13·3	12·2	7·1	3·2	0·8	6·5	1·7	...	...	7·7	9·2	...	7·5	4·9	...	1·9	1·5	...	...	...	...	...	...
XXVII.	Nov. 16. 5 10	40·5	12·5	9·5	15·3	12·0	8·6	5·5	0·5	2·5	...	...	...	...	...	...	...	...	...	2·5	2·0	...	11·5	11·0	10·7	10·7	10·5	11·7
	16. 7 45	36·2	12·7	11·2	17·2	12·7	9·2	5·0	−1·3	1·7	...	...	...	...	...	...	...	...	...	3·1	2·4	...	10·2	11·5	10·2	10·7	9·0	11·2
	16. 8 45	34·8	12·8	9·8	16·8	12·0	8·8	5·6	−2·2	1·8	...	...	...	...	...	...	...	...	...	3·3	2·8	...	10·3	11·3	11·8	14·3	12·8	13·6
	Dec. 8. 4 30	47·6	12·1	11·4	13·6	11·6	8·6	4·3	2·6	2·6	...	...	...	6·6	8·6	8·6	...	...	...	...	0·9	1·6	...	...	...	...	...
XXVIII.	Nov. 16. 9 40	35·5	13·5	12·0	17·5	12·0	10·3	5·7	−1·0	2·5	...	...	...	...	...	...	...	...	...	4·3	3·7	...	13·7	13·5	14·0	15·0	14·5	14·7

Nov. 29, 13h 45m; there is a small quantity of cloud over the zenith. Dec. 8, 5h 0m; there are a few light clouds scattered about the sky. Dec. 8, 12h 15m; dew is abundant.

Table (Continued).

| Excess of the reading of the thermometer in air above that placed | | |

In addition to the tabulated experiments, a variety of others were always in progress. I may mention the results of a few of these.

I placed a large sheet of pasteboard vertically on the grass plat, and laid a thermometer close to its lower edge on each side of it; the readings of both these thermometers thus placed were found to be identical and intermediate to that placed in air at the height of four feet and protected from the effects of radiation, and that placed on grass fully exposed to the sky; the same relation was found to exist in what azimuth soever the board was placed.

I then placed the pasteboard at an angle of 45° nearly with the horizon, and laid the thermometers as before. In this situation their readings were found to be intermediate as before, but that which was exposed to three-fourths of the sky, read most nearly to that on the grass fully exposed to the sky, and the one which was exposed to one-fourth part of the sky only, read most nearly to that in air. The amount of these differences of readings was as nearly as could be determined exactly proportional to the amount of the exposed sky.

Hence, as a general fact it may be considered, that whatever diminishes the view of the sky as seen from an exposed body, causes its temperature to decrease less than it would if the exposure to the sky be complete.

Various experiments were made to ascertain the effect of covering plants at night by matting, or other thin substances; and it was always found that when the protecting substances touched the plant, much heat was conducted away from it, and such plant was at a lower temperature than when the substance was merely interposed between it and the sky; the thinnest substance thus interposed, at any distance from the plant, was found to be effectual in preventing the loss of its heat by radiation. It was found, however, that when a plant was thus itself protected, but yet was exposed to any body which was exposed to the sky, more heat radiated from the former to the latter, than from the exposed body to the plant, and thus it lost some heat.

The several thermometers at the different distances from the earth were for some time read at short intervals during the night and day, and it was found that except after noon, the reading of the thermometer at twelve feet from the earth was very nearly identical with the true temperature of the air.

The bulb of the thermometer thus exposed to the full rays of the sun was situated nine inches west of the plank which carried it, and whose width was three inches; and the cause of its readings being about 1° too high during the afternoon, was owing to the heat reflected from the plank to it.

During the summer of 1844 and the year 1845, the reading of this thermometer was frequently examined, and found always thus to agree. Hence there is no doubt that if a thermometer be freely suspended in the air with its bulb at the height of thirteen feet above the soil, and far from any object to reflect heat to it, its readings will represent the true temperature of the air at the time, and much more truly than those of any one placed near the ground, or within a few feet of walls or buildings.

Excess of the reading of a thermometer placed in air at the height of 4 feet, protected from the effects of radiation, above the readi the one on Long Grass and that in Air, from observat

Number of the Tables.	1844. Day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air: On long grass covered by: On long grass.	On short grass.	On raw wool.	On flax on grass.	In focus of reflector.	Nine inches above wood.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On long grass covered by: White raw wool.	Flax.	White tin.	White tin one inch high.	Blackened tin.	Lead.	Lead six inches high.	Glass.	Glass one inch high.	Hare skin.	Rabbit skin.	Above grass in feet: 1.	2.	4.	6.	8.	10.	12.	On lead: On grass.	Six inches high.	One foot high.
XXIX.	h m	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
	Feb. 21. 11 0	34·1	0·8	0·8	...	...	...	...	...	−1·8	−1·4	...	...	...	...	...	...	...	...	...	...	...	...	0·1	0·2	0·3	0·0	0·3	0·2	...	...	...
XXX.	Apr. 25. 5 45	60·7	2·9	6·2	5·2	2·5	0·2	0·7	−0·3	...	0·7	...	...	...	...	...	...	...	...	...	...	...	−1·4	0·7	0·7	...	0·9	...	1·0	3·2	...	...
XXXI.	Feb. 16. 3 0	45·3	3·8	0·2	3·3	−0·7	3·8	−2·4	4·5	2·1	4·8	3·3	3·8	3·3	3·3	3·3	3·3	1·6	−2·5	3·2	...	...	1·7	−1·4	...	...	...	...	...	0·3	−1·2	...
	Mar. 6. 19 0	39·7	3·1	2·2	2·2	2·7	3·9	1·1	...	...	−0·6	...	...	...	...	...	...	...	...	0·7	...	...	−0·8	0·0	...	...	0·3	...	0·5	2·9	...	...
XXXII.	Jan. 6. 7 30	42·5	4·3	3·7	3·7	3·5	5·8	1·5	0·3	3·5	...	...	...	...	...	...	...	...	...	2·2	...	...	...	0·3	...	...	...	...	...	...	...	...
	Feb. 1. 3 30	35·2	4·3	3·4	3·7	4·3	6·2	1·2	−0·8	0·7	0·2	...	1·7	3·0	3·7	3·7	...	...	3·0	−0·1	...	...	...	−0·8	...	...	...	...	...	1·4	...	...
	Mar. 1. 11 0	41·8	4·3	3·5	2·0	2·9	3·8	0·3	...	...	0·7	...	...	...	...	...	...	...	1·8	1·2	...	...	...	...	...	...	...	...	...	3·8	...	...
XXXIII.	Feb. 7. 19 0	32·3	5·1	4·9	6·1	5·2	7·3	2·1	8·1	0·2	1·7	...	...	...	2·2	...	...	...	...	...	...	...	0·3	0·2	...	...	...	...	...	5·3	...	...
	22. 18 45	24·5	5·8	4·4	5·9	6·0	9·5	3·1	−7·3	−6·2	−6·5	...	...	...	...	...	...	...	4·5	1·5	...	...	...	0·3	−0·2	0·2	−0·1	0·0	0·0	2·9	...	...
	28. 12 0	38·2	5·0	3·7	3·2	3·2	3·2	1·7	0·4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·5	0·4	0·2	0·3	...	0·2	...	...	...
	Mar. 20. 20 10	31·3	5·9	3·5	2·8	5·3	...	...	...	...	...	...	...	...	...	...	...	...	2·1	1·3	...	...	...	...	...	...	...	...	...	0·8	...	...
	Apr. 11. 13 0	46·8	5·8	5·3	7·8	7·6	2·8	1·8	...	...	−0·9	1·3	3·5	...	...	...	...	...	...	...	...	...	...	−0·2	...	...	−0·2	...	−0·2	3·3	...	...
	15. 9 0	48·2	5·2	6·2	8·2	8·2	5·0	1·0	...	...	...	...	...	...	...	...	...	...	...	1·9	...	3·4	...	0·2	−0·4	...	−1·0	...	−1·0	4·2	...	...
	23. 8 55	53·3	5·7	7·1	10·3	7·8	6·5	1·6	1·1	3·3	1·3	...	...	...	...	...	...	...	...	...	...	...	...	0·1	...	...	0·0	...	−0·2	5·8	...	...
XXXIV.	Jan. 18. 19 0	39·5	6·7	5·7	7·3	4·5	6·8	1·9	1·7	4·3	3·1	...	...	...	...	...	...	...	4·7	3·1	...	...	1·0	0·7	...	...	...	...	...	...	...	...
	Feb. 1. 9 0	28·2	6·7	4·7	7·2	5·7	9·2	3·2	−6·0	−4·2	−5·0	−4·2	−3·3	−3·3	−1·8	3·2	...	3·7	4·4	1·2	...	...	0·7	0·2	...	...	...	...	...	3·7	4·7	...
	20. 9 10	30·1	6·9	5·1	3·5	4·9	5·8	...	...	−5·6	−1·9	...	...	...	...	...	...	...	...	...	...	...	1·1	1·0	...	...	...	...	...	6·4	...	...
	22. 14 30	24·4	6·4	5·4	7·3	7·3	10·4	4·8	−8·1	−5·6	−6·8	...	...	...	...	...	...	...	4·8	2·8	...	...	...	1·4	0·6	0·9	0·9	0·8	1·0	3·6	...	...
	22. 16 0	24·3	6·2	5·1	7·3	7·1	10·3	4·4	−8·2	−5·7	−6·7	...	...	...	...	...	...	...	4·3	2·1	...	...	...	1·3	0·3	0·8	0·6	0·8	0·7	3·1	...	...
	22. 17 30	23·6	6·1	4·8	6·9	6·7	9·6	3·0	−8·6	−6·7	−7·4	...	...	...	...	...	...	...	3·8	1·6	...	...	...	0·8	0·1	0·8	0·2	−0·1	0·1	2·4	...	...
	28. 18 30	33·0	6·0	5·0	5·0	5·2	4·0	2·0	...	...	2·5	...	...	...	...	...	...	...	2·0	0·8	...	...	...	0·7	0·6	0·8	0·5	...	0·3	...	...	...
	Apr. 1. 15 30	39·1	6·3	5·1	9·1	9·1	3·6	1·9	−4·4	0·1	−3·5	−6·4	−5·9	...	...	...	...	...	4·1	2·9	−4·9	−2·9	...	0·7	0·1	...	−1·8	...	−3·4	5·1	...	...
	1. 17 0	37·5	6·6	6·5	9·5	9·0	4·5	3·0	−5·5	1·5	1·5	−7·0	−7·5	...	...	...	...	...	3·3	2·0	−5·5	−3·5	...	...	...	...	...	...	...	6·5	...	...
	17. 17 0	44·2	6·2	5·7	11·2	12·0	3·7	1·7	−0·8	4·2	0·7	−3·3	−2·8	...	...	...	...	...	4·7	4·2	−0·8	−0·8	...	0·7	0·3	...	−0·8	...	−0·8	5·7	...	...
	25. 6 15	59·4	6·9	7·4	8·4	6·9	4·4	...	−0·6	3·4	−0·6	...	...	...	...	...	...	...	...	...	...	...	...	1·2	1·1	...	0·2	...	0·4	7·2	...	...
XXXV.	Jan. 6. 5 0	44·5	7·2	6·5	6·9	5·5	4·5	2·5	0·3	3·2	...	...	...	...	...	...	...	...	...	2·9	...	...	0·5	0·1	...	...	...	...	...	...	...	...
	10. 7 0	39·0	7·0	5·8	7·0	3·4	3·5	1·6	0·5	4·0	...	...	...	...	...	...	...	...	...	2·8	...	...	0·0	0·2	...	...	...	...	...	...	...	...
	22. 7 30	37·0	7·5	6·8	11·2	8·0	9·5	3·1	0·2	1·5	2·0	...	...	...	...	...	...	...	4·9	5·8	...	...	2·2	1·8	...	...	...	...	...	...	...	...
	Feb. 22. 6 45	30·6	7·8	6·9	8·8	8·6	11·6	3·6	−3·4	−2·4	−3·7	...	...	...	...	...	...	...	5·6	3·3	...	...	...	1·6	1·4	1·4	1·4	1·3	1·3	...	...	...
	22. 12 30	25·3	7·0	5·0	7·2	7·5	10·7	3·8	−7·4	−5·5	−6·9	...	...	...	...	...	...	...	3·8	2·2	...	...	...	2·5	0·3	1·1	0·8	0·8	0·8	3·2	...	...
	23. 13 0	25·1	7·1	5·8	8·0	7·8	11·3	3·9	−7·4	−4·8	−7·1	...	...	...	...	...	...	...	4·8	2·8	...	...	...	2·1	1·1	1·7	1·3	1·3	1·6	3·6	...	...
	28. 17 0	33·7	7·1	5·5	8·7	6·7	5·2	...	...	...	−3·3	...	...	...	...	...	...	...	0·7	0·5	...	...	...	1·5	0·9	0·9	0·8	...	0·7	6·2	...	...
	Mar. 12. 9 0	38·0	7·9	4·6	7·0	6·0	8·2	2·7	...	...	1·0	...	...	...	...	...	...	...	...	3·4	...	...	...	1·8	−0·2	...	...	...	...	5·5	...	...
	Apr. 1. 14 30	40·2	7·5	5·0	9·9	10·0	4·2	1·7	−4·8	0·2	−2·2	−5·8	−5·3	...	...	−4·8	4·8	4·4	3·2	...	...	...	...	1·6	0·4	...	−0·3	...	−2·0	5·7	...	...
	5. 17 30	41·0	7·2	6·2	7·4	7·8	9·0	2·0	−1·3	...	−1·0	...	...	...	−3·3	...	−0·3	−0·3	3·0	...	...	...	...	0·0	−0·3	...	−0·2	...	−0·4	4·2	...	...
	17. 16 0	44·7	7·2	6·7	14·2	14·7	3·7	1·7	−1·3	3·7	0·7	−3·3	...	...	...	...	...	...	6·7	5·7	...	...	...	0·7	0·3	...	−1·3	...	−1·8	6·4	...	...
	29. 9 0	42·2	7·0	6·2	12·2	11·6	7·2	2·7	−2·8	1·7	2·7	...	...	...	...	...	...	...	...	...	...	...	...	1·0	1·0	...	1·0	...	1·0	7·1	...	...
XXXVI.	Jan. 17. 5 0	41·2	8·7	7·2	6·4	6·2	9·4	2·4	3·2	4·4	4·7	...	4·2	4·9	...	5·7	...	...	5·7	4·0	...	...	...	1·0	...	...	...	...	...	...	...	...
	30. 4 30	46·2	8·2	7·0	7·7	6·4	7·6	1·2	5·0	4·7	3·7	...	...	...	...	...	...	...	5·4	4·3	...	...	...	1·2	...	...	...	...	...	...	...	...
	30. 5 30	43·6	8·6	6·3	9·6	5·6	6·5	1·3	3·5	5·6	2·1	...	...	...	...	...	...	...	5·8	3·6	...	...	...	0·6	...	...	...	...	...	...	...	...
	Feb. 1. 7 0	30·0	8·8	6·0	10·8	8·8	10·0	4·0	−5·0	−2·2	−3·0	2·2	−1·5	2·8	...	4·5	...	3·0	3·5	3·8	...	...	...	0·8	...	...	...	...	...	3·8	4·0	...
	16. 8 0	37·5	8·0	7·0	7·0	7·5	7·5	2·5	−1·0	1·7	1·0	0·3	1·0	2·3	...	2·0	4·0	3·5	6·3	3·7	...	...	...	0·0	...	...	...	...	...	5·3	2·5	...
	Mar. 6. 11 0	33·6	8·6	5·1	8·6	7·4	8·8	2·9	...	...	−1·2	...	...	...	...	...	...	...	...	2·4	...	...	...	1·6	...	...	...	...	...	8·8	...	...
	20. 9 0	32·5	8·5	6·0	8·5	8·5	7·0	3·6	...	1·5	−3·5	...	...	...	...	...	...	...	3·5	1·5	...	...	...	1·0	1·0	0·6	0·5	...	0·5	6·0	...	...
	20. 10 0	31·2	8·2	5·2	8·2	7·2	7·2	3·5	...	1·2	−4·0	−6·8	−5·8	...	...	...	...	...	6·7	4·2	...	...	...	1·2	0·8	0·9	0·2	...	0·2	6·2	...	...
	20. 11 0	31·0	8·2	5·5	9·0	9·0	7·0	3·8	...	0·5	−5·0	−5·5	−5·0	...	...	...	...	...	5·0	3·2	...	...	...	1·2	0·8	0·8	0·5	...	0·2	7·0	...	...
	20. 11 30	30·9	8·4	5·4	10·4	11·4	7·4	3·9	...	−0·1	−4·6	−6·5	−6·1	...	...	...	...	...	6·4	2·9	...	...	...	1·0	0·7	0·7	−0·4	...	0·6	5·9	...	...
	20. 18 30	38·5	8·8	6·3	12·5	13·3	9·2	4·5	...	−0·3	−5·3	1·3	1·8	...	...	...	...	...	3·5	2·9	...	...	...	1·7	1·1	1·5	0·5	...	0·5	5·9	...	...
	Apr. 1. 18 30	40·0	8·6	7·0	8·5	8·5	5·0	3·5	−3·0	1·0	1·0	−3·0	−3·0	...	...	...	...	...	4·5	3·0	−3·0	−3·0	...	2·0	1·5	...	0·0	...	1·3	5·5	...	...
	2. 9 0	48·5	8·7	8·7	12·0	12·0	8·5	3·7	−1·5	5·5	1·5	...	...	...	...	...	...	...	...	...	...	...	...	−0·7	−0·7	...	−1·0	...	−0·7	...	...	...
	8. 13 30	42·1	8·6	9·3	14·3	12·6	6·5	2·4	0·0	2·5	−1·2	...	...	...	...	...	...	...	8·7	6·8	...	...	...	−1·3	−1·3	...	−1·3	...	...	7·9	...	...
	8. 15 30	41·2	8·7	9·5	15·5	13·8	6·5	2·2	−0·9	2·1	1·2	...	...	...	...	...	...	...	7·8	6·8	...	...	...	−0·4	−0·5	...	−0·7	...	...	7·4	...	...
	8. 17 30	39·4	8·6	9·6	15·7	15·8	8·4	2·4	−2·1	2·4	1·6	...	...	...	...	...	...	...	6·4	6·0	...	...	...	0·0	−0·1	...	−0·3	...	...	8·1	...	...
	17. 15 0	45·5	8·5	8·5	16·5	16·5	4·5	2·5	−1·5	3·5	0·5	−4·5	−4·5	...	...	...	...	...	8·0	7·0	−0·5	−0·5	...	0·0	0·0	...	−1·3	...	−1·3	7·5	...	...
	17. 18 30	47·5	8·0	6·3	10·5	8·0	6·3	...	...	...	...	...	...	...	...	...	...	...	5·5	3·0	...	...	...	−2·0	...	...	−0·5	...	−0·5	...	...	...
	23. 7 35	56·0	8·8	7·0	12·0	10·7	6·3	1·7	1·5	4·7	2·2	...	...	...	...	...	...	...	4·0	6·0	...	...	...	0·2	−0·1	...	0·0	...	−0·3	3·8	...	...
	27. 7 3	48·5	8·5	8·5	13·5	12·3	5·5	2·7	−7·8	−1·5	−3·7	...	...	...	...	...	...	...	...	...	...	...	...	1·1	1·0	...	0·9	...	1·0	3·5	...	...

Feb. 21, 11h 0m; a thin rain was falling. Feb. 16, 3h 0m; the sun is shining brightly. Feb. 2

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dings of thermometers placed on different substances fully exposed to the sky, arranged according to the difference of the readings of vations taken between 1844 January 1 and 1844 May.

| air above that placed | | |

TABLE (Co

Number of the Table.	1844. Day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in si																														
			On long grass.	On short grass.	On white raw wool.	On flax on grass.	In focus of reflector.	Nine inches above wool.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On long grass covered by										Above grass in feet.							On lead.				
												White raw wool.	Flax.	White tin.	White tin one inch high.	Blackened tin.	Lead.	Lead six inches high.	Glass.	Glass one inch high.	Hare skin.	Rabbit skin.	1.	2.	4.	6.	8.	10.	12.	On grass.	Six inches high.		
XXXVII.	Jan. 22. 10 30	34·8	9·2	8·6	13·5	8·6	7·6	2·8	0·2	3·0	1·0	°	°	°	°	°	°	°	6·2	4·3	°	°	0·4	0·8	°	°	°	°	°	°	°	°	
	26. 7 30	42·5	9·2	6·9	6·9	5·5	7·3	2·9	4·3	7·3	5·4	...	...	...	...	6·0	...	...	7·0	4·5	...	...	0·9	0·7	...	...	...	...	...	...	...	...	
	Feb. 1. 5 0	33·5	9·0	8·0	10·3	7·3	10·0	6·0	−2·0	0·0	−0·5	3·0	1·0	3·5	3·0	7·0	...	4·5	2·0	4·5	...	...	2·5	2·0	...	...	...	...	...	8·3	4·5	...	
	15. 19 15	34·0	9·8	8·0	7·0	8·5	8·5	4·0	−1·2	1·0	−1·0	2·0	4·0	3·5	6·0	2·0	3·5	2·0	5·0	4·5	...	...	2·0	2·0	...	...	...	...	...	6·5	5·0	...	
	16. 7 0	39·2	9·0	7·2	6·7	7·7	8·5	2·7	1·7	3·0	2·7	0·7	1·7	2·2	2·2	5·4	3·7	3·7	7·2	4·2	...	...	0·7	0·7	...	...	...	...	...	5·7	3·2	...	
	16. 9 0	36·8	9·3	6·8	5·8	7·8	7·6	2·8	0·7	1·3	0·8	1·2	1·1	2·3	1·3	4·3	4·0	3·6	5·6	3·6	...	...	0·8	0·6	...	...	...	...	...	6·3	2·8	...	
	20. 5 0	36·7	9·3	7·2	10·5	9·1	8·7	3·4	0·1	2·3	1·5	0·7	−0·1	−0·4	0·0	...	...	...	...	...	...	...	2·3	1·7	...	...	−0·1	...	...	6·9	...	...	
	Apr. 1. 12 30	42·7	9·5	8·2	14·5	12·7	6·7	2·7	−2·8	3·7	−2·3	−2·3	−2·3	...	...	...	...	...	6·7	5·7	−1·3	−0·8	...	0·9	0·5	...	−0·3	...	−0·8	9·2	...	5	
	1. 13 30	41·3	9·4	9·3	13·3	13·3	6·3	3·1	−3·7	1·3	−2·8	−4·2	−4·2	...	...	...	...	...	6·3	4·3	−3·7	−3·7	...	2·5	0·8	...	1·9	...	−2·0	8·3	...		
	1. 18 0	39·7	9·3	8·9	11·2	9·9	6·7	5·2	−3·3	2·7	1·3	−4·3	−4·3	...	...	...	...	...	5·7	3·7	−3·8	−3·8	...	3·0	2·5	...	...	...	1·7	7·7	...	4	
	2. 7 0	51·9	9·9	6·1	9·9	9·9	8·9	2·9	−0·6	1·9	−0·1	...	−1·6	...	...	...	...	...	6·9	4·9	...	...	...	−1·6	−2·1	...	−4·1	...	−1·9	6·4	...	2	
	3. 17 30	45·6	9·0	7·9	12·6	15·9	7·0	3·0	1·0	5·1	2·2	...	...	...	...	...	...	...	6·4	5·5	...	...	...	−0·8	−0·9	...	−0·9	...	...	9·0	...		
	17. 12 0	48·5	9·3	9·6	14·5	15·3	5·5	2·5	0·5	7·0	3·5	−2·5	−1·5	...	...	...	...	...	7·5	7·5	0·5	0·5	...	0·5	0·0	...	−1·3	...	−1·3	8·7	...	5	
	29. 11 0	39·4	9·6	8·3	12·1	12·8	7·5	4·9	−6·9	−0·4	2·3	...	...	...	...	...	...	...	...	...	...	...	...	1·6	1·2	...	1·2	...	...	8·4	...	4	
	30. 7 40	48·6	9·0	7·3	8·4	7·8	6·6	2·4	−5·8	−0·3	−2·6	...	...	...	...	...	...	...	...	...	...	...	...	1·4	0·8	...	1·2	...	1·1	5·5	...	3	
	Feb. 13. 20 0																						...										
XXXVIII.	Jan. 26. 5 10	42·8	10·3	7·8	9·8	6·8	8·0	3·3	2·8	6·3	5·1	...	...	...	...	5·7	...	...	6·7	4·8	...	...	1·0	0·7	...	...	...	...	...	...	...	...	
	Feb. 15. 15 0	36·8	10·6	8·3	10·8	10·3	9·4	4·4	−0·2	3·3	0·3	2·3	2·8	6·3	5·3	6·3	4·8	5·3	6·3	3·8	...	...	2·3	2·1	...	...	...	...	...	6·3	5·0	...	
	15. 17 30	34·0	10·8	7·8	7·0	10·5	10·0	4·5	−2·0	1·0	−1·0	2·0	2·0	6·0	6·5	4·2	4·7	2·0	6·5	3·5	...	...	2·0	2·0	...	...	...	...	...	7·5	4·9	...	
	16. 4 30	42·7	10·2	8·9	7·5	9·2	9·5	3·2	3·2	4·9	4·5	4·2	3·9	3·7	3·7	4·7	5·7	4·7	5·7	5·7	...	...	1·7	1·2	...	...	...	...	...	7·7	4·5	...	
	22. 9 0	28·1	10·1	7·3	11·6	10·1	11·9	−1·6	−5·9	−3·3	−4·9	...	...	...	...	...	...	...	...	...	...	...	...	2·1	1·1	1·1	0·8	0·8	0·1	8·0	...		
	Mar. 21. 8 40	35·7	10·2	10·2	15·5	15·5	7·7	2·7	...	...	0·2	...	...	...	...	...	...	...	5·0	7·1	...	...	...	−0·9	−0·8	1·1	−0·5	...	...	6·4	...		
	Apr. 2 8	49·2	10·0	9·0	11·9	10·2	6·7	4·2	−0·8	3·2	1·9	0·8	−0·8	...	...	...	...	...	4·2	2·0	1·2	1·2	...	−1·3	−1·3	...	−1·3	...	−1·3	7·2	...	1	
	2. 11 0	47·0	10·0	9·2	12·3	10·0	...	6·0	−0·6	1·0	2·0	7·0	4·0	...	...	...	...	...	5·5	3·7	6·0	5·7	...	−1·4	−1·4	...	−1·0	...	−2·6	...	...		
	8. 11 0	44·4	10·4	10·0	14·2	14·2	6·9	1·8	1·0	4·3	1·4	...	...	...	...	...	...	...	...	...	...	...	...	−0·7	−0·7	...	−0·6	...	...	7·9	...		
	9. 8 50	51·6	10·2	8·6	12·4	11·6	5·4	2·3	2·3	6·6	3·0	...	...	...	...	...	...	...	9·5	4·6	...	...	...	−0·6	−0·6	...	−0·9	...	...	6·8	...		
	17. 13 0	48·8	10·8	10·8	14·8	13·8	6·8	2·8	0·8	6·3	3·3	−1·2	−1·2	...	...	...	...	...	8·3	8·3	0·8	0·8	...	0·6	0·6	...	−0·2	...	−0·2	8·8	...		
	17. 14 0	47·2	10·2	9·2	14·7	13·2	6·2	2·7	0·2	4·7	2·2	−3·3	−3·3	...	...	...	...	...	7·4	6·2	0·2	0·2	...	1·0	0·7	...	−0·8	...	−0·8	8·7	...		
	17. 18 0	44·2	10·2	9·7	14·7	15·7	5·2	2·2	−1·3	5·0	−0·8	−0·8	−0·8	...	...	...	...	...	5·2	5·2	2·2	2·2	...	0·0	0·0	...	0·0	...	0·0	8·0	...		
	18. 17 30	36·3	10·1	9·1	12·5	13·5	11·0	4·7	...	...	−2·0	...	...	...	...	...	...	...	...	...	...	...	...	1·6	1·3	...	1·5	...	1·7	10·3	...		
	25. 6 40	57·7	10·5	8·9	9·2	8·7	6·7	2·7	0·2	2·2	1·2	...	...	...	...	...	...	...	...	...	...	...	...	2·6	2·4	...	2·3	...	2·5	8·2	...	5	
	25. 17 20	41·6	10·8	9·3	12·1	11·1	5·3	3·6	−3·4	4·6	1·9	...	...	...	...	...	...	...	...	...	...	...	...	−0·2	−0·2	...	0·0	...	−0·1	10·5	...	6	
	27. 9 30	45·6	10·6	9·6	13·0	14·3	11·6	4·0	−6·4	−0·2	−1·2	...	...	...	...	...	...	...	...	...	...	...	...	2·6	2·0	...	1·6	...	1·6	7·6	...		
	May 1. 9 5	49·7	10·7	10·7	12·5	13·9	10·8	3·2	−1·6	5·4	0·9	...	...	...	...	...	...	...	...	...	...	...	...	2·3	2·0	...	1·0	...	1·2	8·9	...		
	1. 11 0	46·7	10·7	7·9	10·7	10·2	7·2	3·2	−1·3	4·8	0·5	1·7	1·7	...	...	...	...	...	6·2	6·2	2·7	...	...	1·7	1·3	...	1·2	...	1·2	8·2	...	4	
XXXIX.	Jan. 28. 8 15	36·1	11·7	10·3	16·3	10·7	10·6	3·3	0·2	1·2	3·2	...	...	...	...	...	...	...	6·0	6·0	...	...	1·5	1·3	...	...	...	...	...	...	...	...	
	29. 9 0	35·7	11·7	9·9	16·1	10·8	10·7	3·1	0·3	1·1	3·9	...	...	...	...	...	...	...	5·4	5·5	...	...	1·2	1·0	...	...	...	...	...	...	...	...	
	Feb. 15. 18 30	33·5	11·5	9·0	10·0	10·5	7·5	3·5	2·0	0·7	1·7	1·5	2·5	3·0	3·5	4·5	4·5	2·0	2·0	3·4	...	...	1·8	1·5	...	...	...	...	...	7·3	6·3	...	
	22. 11 30	26·7	11·5	10·2	13·3	13·7	16·1	5·7	−4·8	−3·2	−3·4	...	...	...	...	...	...	...	6·8	4·4	...	...	...	2·7	2·4	2·5	2·4	2·1	2·4	5·7	...		
	Mar. 21. 6 30	39·4	11·4	11·2	13·4	13·2	9·4	3·1	...	5·4	3·1	7·4	5·2	...	...	...	...	...	6·4	5·2	...	...	...	0·2	0·1	...	...	...	...	7·4	...		
	23. 8 40	38·5	11·3	9·0	10·7	12·0	8·7	2·9	...	1·4	0·0	−0·3	0·5	...	...	...	...	...	7·2	6·3	...	...	...	0·3	0·0	...	−0·8	...	...	7·5	...		
	Apr. 1. 9 0	48·5	11·3	9·9	11·3	12·5	8·3	2·3	...	...	1·2	...	...	...	...	...	...	...	6·5	6·5	...	...	...	0·1	0·5	...	...	...	...	8·5	...		
	3. 9 0	47·5	11·7	10·3	17·5	11·7	9·5	2·3	−0·8	...	0·5	...	...	...	...	...	...	...	6·5	4·8	...	...	...	0·2	0·5	...	−0·7	...	−0·8	9·3	...		
	3. 11 30	45·9	11·4	8·4	12·4	12·2	9·4	2·1	−1·2	4·7	3·7	...	...	...	...	...	...	...	6·4	5·7	...	...	...	−2·0	−0·4	...	−0·4	...	...	7·6	...		
	3. 12 45	45·9	11·9	9·7	13·9	15·4	10·3	2·3	0·3	4·9	2·9	...	...	...	...	...	...	...	6·4	5·9	...	...	...	−0·3	−0·3	...	...	...	...	8·3	...		
	3. 15 30	45·8	11·3	9·0	14·5	17·0	9·8	2·8	0·3	5·0	2·7	...	...	...	...	...	...	...	6·3	5·5	...	...	...	−0·4	−0·4	...	−0·4	...	...	8·7	...		
	10. 7 0	55·7	11·9	10·7	13·7	12·7	6·3	2·2	...	...	...	...	...	...	...	...	...	...	5·5	4·2	...	...	...	0·0	0·9	...	...	...	...	6·5	...		
	17. 9 30	52·5	11·2	9·9	15·4	16·5	8·8	3·5	...	...	...	...	...	...	...	...	...	...	8·3	6·1	...	...	...	1·6	1·6	...	0·7	...	...	8·9	...		
	May 1. 7 30	53·1	11·1	10·5	12·1	10·1	10·6	3·1	−0·2	4·1	0·1	...	...	...	...	...	...	...	...	...	...	...	...	2·3	2·1	...	1·5	...	1·7	8·9	...		
	1. 15 0	44·8	11·3	8·8	11·8	12·3	7·3	2·6	−2·7	2·3	−0·7	−0·2	−3·2	...	...	...	...	...	6·3	5·3	...	...	...	2·0	1·6	...	1·1	...	1·1	7·3	...	4	
XL.	Feb. 16. 5 30	42·0	12·0	10·0	11·5	13·0	10·0	4·5	3·0	4·5	4·8	4·5	4·5	5·0	8·0	5·0	8·5	6·5	9·2	6·5	...	...	2·0	1·5	...	...	...	...	...	10·0	7·0		
	Apr. 1. 12 0	44·4	12·9	12·2	16·4	16·4	9·4	4·6	−1·6	−4·6	−1·8	−3·6	...	...	...	...	...	...	5·9	6·6	−1·3	−1·1	...	1·4	1·2	...	0·4	...	0·6	10·9	...	5	
	10. 8 0	53·5	12·5	...	11·5	10·5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	10. 9 0	50·8	12·6	11·5	11·6	15·2	7·1	0·0	...	...	...	...	...	...	...	...	...	...	9·6	6·3	...	...	...	...	...	...	...	...	...	8·6	...		
	18. 9 0	47·5	12·0	9·5	14·5	14·5	8·0	2·3	1·5	6·5	2·3	1·5	...	...	...	...	...	...	9·7	7·7	...	...	...	1·3	1·3	...	−0·5	...	−0·5	7·5	...	5	
	25. 11 30	47·9	12·4	9·7	13·4	12·9	8·9	3·9	−3·3	4·7	0·1	...	...	...	...	...	...	...	...	...	...	...	...	1·9	1·6	...	1·6	...	...	11·7	...	8	
	25. 16 30	41·7	12·4	10·4	15·7	15·5	9·7	6·3	−3·5	6·6	1·8	...	...	...	...	...	...	...	...	...	...	...	...	2·1	0·9	...	1·6	...	1·1	12·0	...		
	May 1. 15 0	41·2	12·2	10·2	15·2	15·2	6·7	5·7	−1·8	4·2	−1·2	−3·8	...	...	...	...	...	...	7·2	6·4	...	...	...	2·4	1·9	...	1·4	...	1·5	9·2	...	6	
	1. 17 0	40·7	12·2	12·2	12·7	16·5	10·7	5·2	−2·3	3·7	−0·7	−2·8	...	...	...	...	...	...	...	...	...	...	...	2·5	2·0	...	1·5	...	1·4	10·2	...	4	
	13. 19 0	54·0	12·7	11·0	15·7	14·0	8·0	4·0	−8·0	...	...	...	...	...	...	...	...	...	6·2	6·0	...	...	...	2·0	...	...	1·0	...	1·0	...	...	...	

Feb. 13, 20h. The minimum temperature of the air the preceding night was 19°, and the lowest reading on raw wool was 7°·8. (See section of self-registering thermometers.)

The appearance of trees and shrubs as covered with hoar-frost was very rich, and on examination it appeared that the edges of the leaves of laurel were fringed with spikes one-tenth of an inch in leng length down each fibre; the intermediate spaces on the leaf itself were covered with small particles. Privet: every leaf was covered from the edge for one-fourth of an inch within the leaf, with spikes one-f branch, by far the greater number, and much larger than the rest springing from the sides; from part of each branch towards the zenith there were comparatively but few spikes, and none of them vertical increased to spikes, becoming longer and longer as the distance from the root increased, terminating at the top in a rich cluster of spikes one-tenth of an inch in length, and inclined at all angles from 0° to 9 one inch high was covered with spikes one-sixteenth of an inch in length, with horizontal spikes one-tenth of an inch in length from its edges. Glass on grass was free of hoar-frost, and so were copper, le direction of the fibres. Raw wool was richly encrusted in each fibre, and in some parts spikes were piled on spikes, forming a cluster three-fourths of an inch in length. On flax there were no spikes, it bei

(Continued).

| in air, above that placed | | |

TABLE (Cont

Number of the Table.	1844. Day, hour and minute.	Reading of Therm. at the height of 4 feet above the soil, protected from radiation.	Excess of the reading of the thermometer in air, ab																																
			On long grass.	On short grass.	On white raw wool.	On flax on grass.	In focus of reflector.	Nine inches above wool.	One inch below surface of ground under short grass.	On surface of ground under short grass.	On surface of ground under long grass.	On long grass covered by											Above grass in feet.						On lead.		
												White raw wool.	Flax.	White tin.	White tin one inch high.	Blackened tin.	Lead.	Lead six inches high.	Glass.	Glass one inch high.	Hare skin.	Rabbit skin.	1.	2.	4.	6.	8.	10.	12.	On grass.	Six inches high.	One foot high.
XLI.	Mar. 23.	h m 7 45	46·9	13·6	11·1	14·9	15·7	10·1	3·8	...	5·2	8·1	1·9	3·5	...	...	...	...	...	...	8·4	7·8	...	...	...	0·1	0·1	...	0·3	...	...	9·6	...	...
	Apr. 3.	7 0	51·3	13·1	11·5	18·3	17·3	9·2	2·3	0·4	...	3·6	...	...	...	...	...	...	...	...	...	5·3	...	...	...	0·4	0·5	...	0·0	...	0·1	10·3	...	...
	6.	7 25	49·2	13·2	10·2	14·2	13·2	9·2	3·5	0·2	...	3·0	...	...	...	...	...	...	...	...	...	...	...	...	...	1·9	1·2	...	1·2	...	1·2	5·1	...	...
	9.	7 50	52·3	13·1	10·8	17·1	17·8	9·3	1·7	2·1	7·6	4·5	...	...	...	...	...	...	...	10·5	7·7	...	...	...	...	0·4	0·5	...	3·6	...	...	9·3	...	...
	17.	11 0	48·5	13·0	12·0	18·5	18·5	7·5	3·0	0·0	6·0	5·0	−2·5	−3·5	...	...	...	...	...	10·0	6·5	−1·1	−0·5	...	...	0·6	1·0	...	1·5	...	2·0	10·3	...	5·7
	18.	11 5	49·5	13·5	12·0	17·5	17·7	12·2	0·7	...	...	0·7	...	...	...	...	...	...	...	...	...	...	...	...	...	1·7	1·3	...	0·3	...	0·2	9·9	...	...
	24.	14 40	40·0	13·2	12·0	18·0	18·0	10·4	6·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2·0	2·0	...	1·5	...	1·5	10·0	...	...
XLII.	Apr. 24.	9 30	48·5	14·5	12·5	18·0	16·5	9·5	5·5	1·0	6·5	3·0	...	...	...	...	...	...	...	11·0	8·3	...	...	...	...	1·7	1·2	...	0·7	...	0·5	10·5	...	7·3
	24.	10 0	47·5	14·5	12·3	18·5	16·3	9·8	5·3	0·5	7·0	1·5	...	...	...	...	...	...	...	9·5	7·0	...	...	...	...	2·0	1·8	...	1·3	...	1·2	11·5	...	8·0
	24.	10 30	46·8	14·8	12·7	18·3	16·8	8·8	6·1	−0·2	6·3	1·6	...	...	...	...	...	...	...	11·6	6·3	...	...	...	...	0·9	0·6	...	0·6	...	0·5	12·8	...	8·3
	24.	12 40	44·1	14·5	12·7	17·9	16·9	8·1	6·6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1·9	1·5	...	0·9	...	0·6	12·1	...	7·5
	24.	13 40	42·8	14·4	10·8	17·3	15·8	9·6	5·8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1·2	1·1	...	1·0	...	0·6	12·8	...	6·0
	25.	15 40	42·3	14·3	12·1	17·2	17·8	12·1	6·2	−4·3	8·3	0·4	...	...	...	...	...	...	...	...	...	...	...	...	...	2·5	0·9	...	0·8	...	...	13·2	...	8·1
XLIII.	Apr. 1.	11 0	46·7	15·2	13·2	17·2	17·2	9·7	5·7	0·7	3·7	1·2	−1·3	−1·7	...	...	...	...	...	10·2	9·5	−0·3	−0·3	...	...	2·7	2·5	...	0·7	...	0·7	11·5	...	7·5
	8.	9 0	46·3	15·9	14·4	21·3	22·3	11·3	...	...	...	...	...	2·0	...	...	...	...	...	...	...	...	...	...	...	1·7	...	...	3·7	...	3·7	11·5	...	...
	9.	7 30	53·8	15·8	14·3	14·8	16·0	13·8	1·2	2·6	8·6	4·0	−1·2	...	...	...	...	...	...	13·2	8·6	...	...	...	...	0·9	...	...	2·2	...	...	10·3	...	...
	24.	9 0	49·5	15·5	13·5	17·5	17·5	10·5	5·3	1·5	7·5	1·5	1·3	...	...	3·5	...	...	...	11·5	7·5	...	...	...	...	1·7	...	...	1·0	...	0·8	9·7	...	7·0
	24.	11 0	45·7	15·2	12·5	19·2	16·5	10·2	6·8	−1·3	8·0	0·7	1·4	...	...	−0·3	...	...	...	11·2	7·7	...	...	...	...	1·6	...	...	0·9	...	0·9	12·2	...	9·7
	24.	11 30	45·6	15·6	13·1	19·6	18·1	10·2	7·1	−1·4	8·6	0·6	1·6	...	...	−0·4	...	...	...	11·1	9·1	...	...	...	...	1·6	...	...	0·8	...	0·8	12·1	...	9·6
	24.	12 0	44·7	15·2	12·7	19·5	18·2	9·7	7·2	−2·3	7·2	−0·3	1·7	...	...	−0·8	...	...	...	10·2	8·2	...	...	...	...	1·9	...	...	1·5	...	1·2	9·9	...	3·7
XLIV.	Apr. 8.	7 20	52·7	19·2	17·5	21·7	22·7	12·7	...	2·7	...	8·7	...	2·2	...	...	...	...	...	16·2	...	...	...	...	...	1·4	2·0	...	1·2	...	0·5	14·7	...	12·2
	8.	8 0	48·0	19·6	18·0	25·0	23·0	12·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3·5	...	3·5	13·0	...	...

(ontinued).

| r, above that placed | | |

From the preceding tables we learn the following particulars:—Tables I. to VI., XVII. to XX., and XXIX. to XXXII. contain the results of observations when the excess of air-temperature above that of long grass was less than 5°; such observations having been taken at times when the sky was wholly covered with cirro-stratus cloud, after having been cloudless, during which state a series of observations had been taken. By examining the last column of these Tables, it will be seen that when the excess of air-temperature above that of long grass has amounted to 4° or 5°, the clouds have been noted as being high, and when the excess was less than 3°, they have been mentioned as being low, or no mention has been made as to their height. Tables VII. to X., XXI. to XXIV., and XXXIII. to XXXVI. contain the results of observations at times when the excess amounted to 5°, 6°, 7°, or 8°; and from the last columns in those tables, it appears that at such times the sky was frequently cloudy, and when wholly so, that the clouds were high; that the air was in frequent motion, and at times the wind was blowing with a pressure of 4 lbs. on the square foot; that the atmosphere was occasionally thick by haze or vapour, and that dew was seldom deposited. Tables XI. to XIV., XXV. to XXVII., XXXVII. to XL. contain the results of the observations at times when the excess was 9°, 11°, or 12°; and at those times the sky has been generally clear, the air calm, and the atmosphere frequently hazy, misty, or vapour or fog was prevalent. Dew was also frequently deposited; in two cases contained in Tables XI. and XXXVII. occurring 1843, Nov. $12^d\ 13^h\ 5^m$, and in 1844, Feb. $20^d\ 5^h$, the sky was wholly covered by high and thin clouds. Tables XV. and XVI., XXVIII., XLI. and XLII., exhibit the results when the excess was 13° and 14°, and at those times the sky was generally clear, and the air was calm; haze and vapour were occasionally prevalent. Tables XLIII. and XLIV. contain the results when the air-temperature exceeded that of long grass by quantities varying from 15° to 19°; and by examining the last column of these Tables, it appears that at those times the sky was cloudless and bright, the atmosphere was clear without haze, mist or vapour, and a perfect calm prevailed.

From the above particulars it appears that at times when the sky was entirely covered with low cirrostratus clouds, the readings of a thermometer placed on long grass was the same as that in the air; that with the same clouds at a moderate elevation, the reading of the thermometer in air has exceeded that on long grass by 3°; and on those clouds being high, this excess has amounted frequently to 5°; and if other clouds than cirrostratus covered the whole sky this excess has been as large as 10°. At times when the sky has been free from clouds but not bright, haze and vapour being prevalent, the above excess has amounted to 10°, 11°, or 12°; and at times when the sky has been both bright and clear, with the air calm, no mist, haze, vapour or fog being prevalent, this difference has frequently amounted to 14°, less frequently to 19°, and sometimes to 20°.

In Tables XLII. to XLIV. are exhibited the great excess of the reading of a thermometer in air above those of thermometers placed on substances whose power for

conducting heat was bad, such as raw wool, flax, hare-skin and rabbit-skin, and contrary to expectation, even on metals, whose power for conducting heat is good.

In Table XLIV. the reading of a thermometer on raw wool was 25° less, whilst another placed at 8 feet from the ground and fully exposed to the sky, was 3°·5 greater than that in air at the height of 4 feet and protected from radiation, and thus a difference of 28°·5 existed between the readings of two thermometers, the one placed on raw wool, and the other in air at the height of 8 feet. This difference was the greatest that I have ever seen, and it occurred in 1844, on April 8^d, at 8^h.

The general agreement in the relative radiating powers of the different substances on different nights, and many other particulars, will be best seen by consulting Tables I. to XLIV.

I shall now proceed to explain the formation of the following table of the mean results derived from all the observations.

The mean of the numbers was taken in every group of results contained in Tables I. to XLV., for every different substance or different position of the thermometer in each period of observation, thus forming three large tables; from these a fourth table was formed by combining the mean results for every substance, according to the number of observations from which each had been deduced, omitting, however, all those which had been taken when the excess of air-temperature above that of long grass temperature was less than 2°*. From the numbers in this last table the next table was formed.

The last column but two in the following table contains the mean excess of the reading of the thermometer in air above those placed as stated in the first column, derived from all the observations made on each substance, &c. These numbers are smaller than they would have been had the observations been made in a wide and open plain (see introductory remarks), and also if the thermometer in the air had been perfectly protected from the effects of radiation (see remarks following Table XLV.). The numbers in the last column but one represent the relative radiating power of the several substances, that of long grass being considered as 1000. It is probable that these numbers are very accurate, for had the results in the preceding columns been larger than they are, they would have been relatively so, consequently the numbers in this column would not have been affected.

In most cases the experiments have been sufficiently numerous to give results worthy of entire confidence, the numbers in this column having been deduced from upwards of 10,000 experiments.

* These four Tables are in MSS. and placed with the series of observations.

Table XLV.

The mean excess of the reading of a thermometer placed in air at the height of four feet above the soil and protected from the effects of radiation, above those of thermometers placed on different substances, or in different situations, fully exposed to the sky.

Situation of the thermometer, its bulb, or the substance under which it was placed, being fully exposed to the sky.	Whole number of comparisons.	Whole sum of the excesses of the readings of the thermometer in air at the height of four feet, above those placed as stated in the first column.	Mean excess of the reading of the thermometer in air.	Relative excess, that of long grass being represented by 1000, or comparative radiating power.	Remarks.
On long grass	479	4017·7	8·39	1000	
On short grass	473	3454·7	7·30	870	
One inch below the surface of ground under grass	273	− 476·1	− 1·75	− 209	
On surface of ground under long grass	156	85·0	0·55	66	
On surface of ground under short grass	259	437·3	1·69	200	
On long grass covered by white raw wool	66	11·9	0·18	22	
On long grass covered by flax	61	20·4	0·35	42	
On long grass covered by white tin	35	119·3	3·41	406	
On long grass covered by white tin one inch high	42	126·3	3·00	357	
On long grass covered by blackened tin	28	131·9	4·71	561	
On long grass covered by lead	10	46·7	4·67	556	These observations were generally simultaneous.
On long grass covered by lead six inches high	13	40·1	3·08	367	
On long grass covered by glass	127	727·9	6·01	716	These observations were generally simultaneous.
On long grass covered by glass one inch high	128	557·5	3·35	399	
On long grass covered by hare-skin	18	13·6	0·75	89	These observations were simultaneous.
On long grass covered by rabbit-skin	17	10·1	0·60	72	
One inch high above the top of grass (in air)	226	1272·9	5·63	671	
Two inches high above the top of grass (in air)	9	43·0	4·78	570	These factors, multiplied into the mean radiating power of any substance, will show the cooling effect of that substance upon the air, at that distance above it corresponding to the factor used.
Three inches high above the top of grass (in air)	89	336·1	4·00	477	
Six inches high above the top of grass (in air)	165	394·1	2·37	282	
One foot high above the top of grass (in air)	219	229·4	1·08	129	
Two feet high above the top of grass (in air)	199	143·3	0·72	86	
Four feet high above the top of grass (in air)	87	50·3	0·58	69	
Six feet high above the top of grass (in air)	18	7·9	0·44	52	
Eight feet high above the top of grass (in air)	96	13·4	0·14	17	
Ten feet high above the top of grass (in air)	9	80·0	0·89		See simultaneous observations at 8 feet and 10 feet.
Twelve feet high above the top of grass (in air)	77	9·0	0·12	14	
On black-lead in powder on the raised board	138	808·1	5·85	697	
On charcoal in powder on the raised board	153	996·2	6·51	776	
On whiting in powder on the raised board	67	465·5	6·94	827	
On chalk in powder on the raised board	21	142·1	7·05	840	
On lamp-black in powder on the raised board	14	113·0	8·06	961	
On unwrought white cotton wool on grass	228	2074·6	9·10	1085	See simultaneous observations.
On unwrought white cotton wool on the raised board	15	127·7	8·52		
On white raw wool on grass	357	3655·1	10·24	1222	
On flax on grass	461	4563·6	9·90	1186	See simultaneous observations.
On flax on the raised board	17	76·3	6·94		
On yellow cotton, jeweller's wool, on grass	13	84·1	6·46	770	None of these observations were simultaneous.
On yellow cotton, jeweller's wool, on the raised board	56	472·0	8·43	1005	
On blue cotton, jeweller's wool, on grass	12	84·6	7·05	840	None of these observations were simultaneous.
On blue cotton, jeweller's wool, on the raised board	55	460·3	8·37	997	
On white wadding on grass	27	223·1	8·27	986	
On black wadding on grass	20	166·6	8·33	993	
On flannel on grass	29	212·1	7·31	871	None of these observations were simultaneous.
On flannel on raised board	55	408·7	7·43	886	
On raw silk on grass	32	254·0	7·84	934	None of these observations were simultaneous.
On raw silk on the raised board	50	464·3	9·29	1107	
On silk from the cocoon	24	208·1	8·67	1034	
On jet black lambs' wool	33	205·4	6·22	741	
On white lambs' wool	33	227·5	6·89	821	These observations were always simultaneous.
On green lambs' wool	33	220·2	6·76	806	
On light blue lambs' wool	33	242·6	7·35	876	
On dark blue lambs' wool	33	230·2	6·98	832	

The observations in air at the height of ten feet above grass, were made on one night only, viz. on 1844 April 24, and the readings were between those of eight feet and twelve feet.

No certain difference appeared from many simultaneous observations of fine and coarse flax, and consequently their results have been combined in the formation of the final values for flax.

TABLE (Continued).

Situation of the thermometer, its bulb, or the substance under which it was placed, being fully exposed to the sky.	Whole number of comparisons.	Whole sum of the excesses of the readings of the thermometer in air at the height of 4 feet, above those placed as stated in the first column.	Mean excess of the reading of the thermometer in air.	Relative excess, that of long grass being represented by 1000, or comparative radiating power.	Remarks.
On orange lambs' wool	33	233·3	7·07	844	These observations were always simultaneous.
On yellow lambs' wool	33	239·5	7·26	855	
On red lambs' wool	33	223·3	6·77	807	
On crimson lambs' wool	33	225·3	6·83	814	
On garden mould	151	598·5	3·96	472	These observations were generally simultaneous.
On gravel	149	361·4	2·42	288	
On river sand	157	599·0	3·81	454	See simultaneous observations.
On river sand on the raised board	25	127·6	5·10		
On tinfoil	33	129·8	3·94	470	
On lead	224	1421·7	6·35	757	See simultaneous observations.
On lead six inches high	13	53·2	4·10		
On lead one foot high	48	261·3	5·44		
On lead three feet high	2	10·5	5·25		
On copper	172	1210·5	7·04	839	
On iron	161	868·2	5·39	642	See simultaneous observations.
On zinc	213	1217·9	5·71	681	
On zinc six inches high	29	175·2	6·04		
On zinc one foot high	6	29·4	4·90		
On zinc three feet high	6	27·0	4·50		
On zinc four feet high	4	13·2	3·30		
On white tin	112	616·6	5·51	657	
On white tin one inch high	75	378·0	5·04	601	Generally simultaneous observations.
On blackened tin	104	672·2	6·46	770	
In focus of metallic parabolic reflector	464	3340·7	7·20	858	
On the raised board	50	323·4	6·49	773	
On saw-dust in a box on the raised board	37	189·3	5·12	610	
Nine inches above wood and protected from lateral wind	394	1236·8	3·11	371	
On brick	46	143·5	3·12	372	
On pantile	111	437·2	3·94	470	
On slate	100	481·1	4·81	573	
On glass	163	1182·3	7·25	864	These observations were generally simultaneous, and with them the observation of grass under the glass.
On glass one inch high	156	954·1	6·11	728	
One quarter of an inch above water	83	225·7	2·72	324	
On paper on the raised board	8	41·2	5·15	614	
On hare-skin	70	773·1	11·04	1316	
On rabbit-skin	59	613·2	10·40	1240	See simultaneous observations.
On stone	154	503·3	3·27	390	
Number of observations of the thermometer in air, and its mean reading	487		43·7		

No certain difference was found from many simultaneous experiments on lead less than the twentieth of an inch in thickness, and lead a quarter of an inch in thickness; the observations are everywhere used as lead, independently of its thickness. The same remark applies to the three different thicknesses of zinc, and to the three different stones used; and their results have been combined as one result for "zinc," and as one result for "stones" in the final result.

Some of the particulars which we may learn from the preceding table are the following.

The first results contained in it are those relating to grass, whose radiating power appears to be such, that the reading of a thermometer when placed on it when long, is less than when it is placed on short by 1°·1; the next result relating to grass is that of the temperature on the surface of the soil under it, which is such that the reading of a thermometer under long, exceeds that under short by 1°·1; being exactly the same amount in excess under as it was in defect on the top; and hence the cause of the difference of the readings on the top of long and short grass arises solely from the greater quantity of heat conducted to the surface of the latter from

the soil, over that conducted to the surface of the former, and not from the greater quantity of heat radiated into space from the long, over that radiated from the short; such being the case, it was to be expected that the readings of a thermometer would vary with every variation of the length of grass upon which it was placed, and such was found to be the case.

In fact, the readings of thermometers placed on grass were found to differ with every variation of length, fineness and closeness of its blades. My experiments have been made on that differing only in the length of its blades, and the differences arising from this cause were found to vary with every variation of the excess of the temperature of the air over that of long grass. The following are the mean results of experiments in this respect:—

When the excess of air-temperature at the height of 4 feet above that of long grass was	between 3° and 7°	the reading of the thermometer on short grass was higher than that on long grass by	0°·8	from 125 comparisons.
	between 7° and 10°		1°·3	from 231 comparisons.
	between 10° and 19°		1°·9	from 86 comparisons.

These differences were found to correspond to a mean temperature of the air of 44°, and that of long grass of 36°, or generally to all temperatures above 30°; but when the reading of long grass declined below 30°, that of short grass was found not to decline nearly so rapidly: investigating the temperatures at readings below 30°, the following are the mean results:—

That when the reading on long grass was between	25° and 30°	it exceeded that on short grass by	2°·0	from 10 comparisons.
	20 and 25		2·4	from 31
	15 and 20		3·3	from 19
	10 and 15		4·8	from 14
	5 and 10		6·4	from 9
	0 and 5		9·4	from 2

From another investigation, it appeared that these differences were connected with the difference between the readings of the thermometer in air and that on long grass as follows:—

When the reading of the thermometer on long grass was	at and above 30°	the excess of the reading of the thermometer on short grass was	one-eighth part,	of the excess of the reading of the thermometer in air at 4 feet high, above that on long grass.
	at 20°		one-fourth part,	
	at 10°		one-half,	
	at 0°		the whole,	

Hence it appears that at the reading of 0° of the thermometer on long grass, the reading of a thermometer on short grass is as much higher than 0°, as the reading of the thermometer in air at the height of 4 feet is higher than 0°; or that the readings on short grass and that in air are alike, and therefore that the heat conducted from the earth equals in amount the heat lost by radiation; and that for readings on long grass increasing from 0° in an arithmetical progression with a common difference of 10°, the difference between the readings on long and on short grass becomes less in geometrical progression with a common ratio of one-half; till attaining a reading of 30° the difference equals the fourth term of the series, and this difference continues very nearly constant till 60°, above which temperature I have had but few experiments. If we call the excess of air-temperature above that of long grass temperature by e, then the excess of the readings on short grass above those on long grass at

0°, 10°, 20° and at 30°, and above 30°, will be respectively e, $\frac{1}{2}e$, $\left(\frac{1}{2}\right)^2 e$, $\left(\frac{1}{2}\right)^3 e$; and for any intermediate reading the difference can be easily calculated from these terms. The very singular and unexpected facts now detailed, merit attention and suggest the necessity of carefully noting the position of a thermometer in any investigation in which such instrument is needed, as indeed do all the experiments that I have made, though not in so marked a manner as does this. I now proceed to the results of those experiments in which grass was covered by different substances, which are as follows:—

The covering of long grass by	caused the thermometer to read higher than one placed on uncovered grass by	the whole	of the difference between the thermometer in air at the height of 4 feet and that on long grass	or in its mean, caused the covered grass to be warmer by.....
raw wool, flax, hare-skin or rabbit-skin	,, ...	five-eighths	... ,, ...	,, ... 8°·0
a sheet of white tin ...	,, ...	five-eighths	... ,, ...	,, ... 5·0
a sheet of white tin one inch high ...	,, ...	five-eighths	... ,, ...	,, ... 5·4
a sheet of blackened tin	,, ...	three-eighths	... ,, ...	,, ... 3·6
a sheet of lead	,, ...	three-eighths	... ,, ...	,, ... 3·6
a sheet of lead 6 inches high	,, ...	five-eighths	... ,, ...	,, ... 5·4
a sheet of colourless glass	,, ...	one-fourth ...	... ,, ...	,, ... 2·4
a sheet of colourless glass 1 inch high	,, ...	five-eighths	... ,, ...	,, ... 5·0

The following are some of the particulars that we may collect from these results. The filamentous substances and skins did not allow any heat to escape from the grass they covered, thus proving them to be very bad conductors of heat. The raising any substance above the grass caused the thermometer reading to increase, although in this case it must have been exposed to a portion of the sky: this in the case of tin was a small quantity; in the cases of lead and of glass the quantity was large, with the former amounting to 1°·7, and with the latter to 2°·7 in their means. The amount of heat transmitted through a colourless medium, as glass, is remarkable, the mean amount of radiation from grass thus covered being less by only one-fourth part of that of uncovered grass.

The next investigation connected with grass was that of placing thermometers at different distances from it, with the view of determining the cooling effect of a body, as cooled by radiation, upon the air in contact with it; the results of these experiments as contained in the table, will probably be more clearly seen by arranging the numbers on the supposition that the reading of a thermometer on long grass was 0°, and combining with them those of 1 inch below and on the surface of the soil as follows:—

At one inch below the surface of the soil the mean reading would be . . .	10°·24
On the surface of the soil under long grass the mean reading would be . .	7·84
On long grass fully exposed to the sky the mean reading would be	0·00
One inch above long grass fully exposed to the sky the mean reading would be	2·76
Two inches above long grass fully exposed to the sky the mean reading would be	3·61

Three inches above long grass fully exposed to the sky the mean reading would be 4°·39
Six inches above long grass fully exposed to the sky the mean reading would be 6·02
One foot above long grass fully exposed to the sky the mean reading would be 7·31
Two feet above long grass fully exposed to the sky the mean reading would be 7·67
Four feet above long grass fully exposed to the sky the mean reading would be 7·81
Six feet above long grass fully exposed to the sky the mean reading would be 7·96
Eight feet above long grass fully exposed to the sky the mean reading would be 8·26
Twelve feet above long grass fully exposed to the sky the mean reading would be 8·27
And the one in air at the height of four feet, protected from six-tenths of the sky, would be . . . . . 8·39

The numbers in the last column of Table XLV., opposite to the respective heights above long grass, are factors deduced by considering the radiation from long grass to be represented by unity, and therefore the numbers represent the factors corresponding to the cooling effect of a body cooled by radiation upon the air at different heights above it. They may be considered to apply to all bodies whose radiating powers are known, the cooling effect of which upon the air at any particular distance above them, less than twelve feet, will be known by multiplying the mean radiating power into the factor corresponding to that distance.

The greater coldness of grass than that of the air in clear and calm weather, in places sheltered from the sun but open to a considerable portion of the sky, may continue all the day as well as night, and from many unrecorded observations, this appears to occur frequently. On September 22^{d}, 1843, this was observed to be the case; the day was fine, the sky was nearly cloudless, and the reading of the barometer was high. A thermometer on the grass was placed in the shade, and exposed to as much of the sky as possible, and the following observations were taken:—

1843. Month, day, and hour.	Reading of thermometer		Excess of reading of thermometer in air above that on grass.	Remarks.
	In air.	On the grass.		
h m	°	°	°	
Sept. 21. 21 30	62·8	58·5	4·3	Cloudless; dew abundant.
22 15	60·0	54·3	5·7	Cloudless; dew in globules on grass.
23 20	65·5	64·0	1·5	Large clouds to the north; dew abundant.
23 50	66·5	61·5	5·0	Cloudless; dew abundant.
Sept. 22. 0 0	69·0	62·0	7·0	A few clouds to the north.
1 0	68·9	61·5	7·4	Thin clouds to the north.
1 40	68·7	59·0	9·7	Cloudless.
1 53	68·7	58·8	9·9	Cloudless.
3 30	67·0	58·4	8·6	Cloudless.
4 0	66·6	59·4	7·2	Cloudless.
4 20	66·3	58·7	7·6	Cloudless.
4 35	65·8	57·5	8·3	Cloudless.
5 0	65·2	56·8	8·4	Cloudless.

The thermometer was frequently moved so as to keep it in the shade, and on grass upon which the sun had not shone for a long time.

At noon on this day a thermometer was placed on grass upon which the sun had been shining till Sept. 21^d, 23^h 45^m, and the following observations were taken :—

1843. Month, day, and hour.		Reading of thermometer		Excess of reading of thermometer in air above that on grass.	Remarks.
		In air.	On the grass.		
	h m	°	°	°	
Sept. 22.	0 0	69·0	67·0	2·0	A few clouds to the north.
	1 0	68·9	64·5	4·4	Thin clouds to the north.
	1 40	68·7	64·0	4·7	Cloudless.
	3 30	67·0	61·7	5·3	Cloudless.
	4 0	66·6	61·5	5·1	Cloudless.
	4 20	66·3	61·0	5·3	Cloudless.
	4 35	65·8	59·7	6·1	Cloudless.
	5 0	65·2	59·0	6·2	Cloudless.

During the whole of this day the temperature of the grass in the shade was several degrees below that of the air at four feet above it, and dew remained all day upon that portion of grass upon which the sun had not shone. Also the temperature of that upon which the sun had been shining soon began to decline, but it did not descend so low as that of the dew-point, which was about 58°, and therefore no dew was deposited upon it.

This day followed a long period of hot weather without rain, and the day was nearly cloudless, with the sun shining brightly.

This closes the experiments connected with grass with mercurial thermometers, and it will be seen that I have paid very much attention to them, as grass is a substance upon which many former experiments have been made, the discrepancies between which are now fully accounted for.

I may here point out one important result of the preceding experiments; viz. the amount of the corrections dependent upon the portion of clear sky to which the bulb of a thermometer is exposed, necessary to be applied to its readings to obtain from them the true temperature of the air. As a thermometer at the height of four feet, protected from six-tenths of the sky, was found to read 0°·58 higher than another at the same height fully exposed to the sky, it follows that the effect of protecting the bulb of a thermometer from the sky, whose height from the ground was four feet, was to cause the readings to increase 0°·1 for every tenth part of the sky protected: hence, if a thermometer be wholly exposed to the sky, it is necessary to increase its readings by

$$0^\circ{\cdot}1 \times \text{number of tenths of cloudless sky};$$

and if the bulb be partially protected from the sky, the correction is

$$\left(10 - \left\{\begin{array}{l}\text{quantity of sky in tenths from}\\ \text{which the bulb is protected}\end{array}\right\}\right) \times 0^\circ{\cdot}1 \times \text{number of tenths of clear sky.}$$

From this it appears that the thermometer, which throughout all the experiments has been considered to have been protected from the effects of radiation, was yet subjected to it to the amount of 0°·4 on a cloudless sky, or to 0°·4 × number of tenths of clear sky at times when the sky was partially cloudy.

If attention be paid to the placing of thermometers, so that their bulbs be in the shade, protected from rain and from the effects of radiation from walls (by placing their bulbs at least six inches from them), but in other respects freely exposed to the air, and correcting their readings by the preceding formulæ, it will ensure the obtaining the true temperature of the air from them at night. To avoid the effects of reflected heat during the day, the thermometers should be placed at a greater distance than six inches from walls, &c., and their readings corrected as before by the preceding formulæ. No simple rules have hitherto been given for placing a thermometer so that from its readings the true temperature of the air could be deduced.

The readings of thermometers placed on grass being found so variable, the unfitness of it to furnish the means of comparing the degrees of cold at night on the surface of the earth was evident. A much greater uniformity was observed in the results of experiments made with other substances, which were bad conductors of heat, and whose condition was always the same.

Of all the substances experimented upon, those on which the readings of the thermometers have been the lowest were hare-skin and rabbit-skin*; and upon the filamentous, as raw wool, flax, unwrought cotton wool, and raw silk, the readings upon all of which were more steadily less, on clear and calm nights, and exhibited a greater degree of cold, than those on grass. Among bodies of this class, raw wool exhibited a lower reading at all times than any of the rest; the circumstance of hare-skin and rabbit-skin exhibiting a lower mean in the table is accidental, experiments on these substances having been made only during the finest nights, and on which nights raw wool exhibited lower readings than they did. The next in order is flax, both fine and coarse, and in its mean it exhibits a radiating power very nearly equal to that of raw wool; but the last-mentioned substance was much more sensible on the approach of a cloud than any other substance: on those nights which were clear for many hours, raw wool obtained its lowest readings long before flax; and the readings on wool, on the approach of a cloud, increased much sooner than those on flax; and in consequence of the latter circumstance, the mean values deduced from raw wool and flax were nearly the same. In intervals of clear sky, between cloudy states of it, the difference between the readings of two thermometers, the one in air and the other on raw wool, was the greatest of any of the differences. The rapidity of the decrease of the readings on raw wool from a cloudy to a clear sky was about a degree per minute, so that a change in the readings of 15° has taken place in a quarter of an hour. The greatest difference between the temperature of a body at night on the surface of the earth, and that of air a few feet above the earth, was 28°·5; this extraordinary difference occurred in 1844, April 8^{d}, at 8^{h} (See Table XLIV.). The times

* Thus explaining the fact frequently noticed by sportsmen, that the snow upon which hares have been lying is never in the slightest degree melted.

at which other large differences took place, with their amounts, will be seen in Section II.

The next class of bodies consisted of black and white wadding, flannel, and wool of different kinds and colours. Of these, black and white wadding exhibited the lowest readings, and were nearly equal in amount; flannel was the next in order, and the various-coloured lambs' wool were the next; but the differences between those bodies with respect to their radiating powers were not large; they were all, however, inferior in their radiating powers to bodies of the first class. It will be seen in Table XLV. that the numbers opposite to flannel, yellow and blue cotton wool, when those substances were placed on the raised board, are larger than those numbers with the same substances placed upon grass; these differences most probably arose from the different quantities of heat which they received from the parts beneath, the several substances being slow conductors of heat.

The observations upon the coloured wools were too few to indicate positively the influence of colour, nevertheless they were all good and simultaneous experiments. The order of their radiating power is black the lowest, then green, white, crimson, scarlet, orange, yellow, dark blue and light blue successively, the difference between light blue and black being $1^{\circ}.3$. The same parcels of wool were exposed to the direct rays of the sun many times, and as nearly similarly situated as possible. The mean of fifty-eight simultaneous readings of the thermometers placed on them gave—

Black	105°
Yellow	105
Scarlet	107
Orange	109
White	110
Green	110
Crimson	110
Dark blue	110
Light blue	121

Thus black and light blue are at the extremes of the absorptive powers, and so far confirm the results obtained by the night observations, as the absorptive power of substances is proportional to their radiating power.

But as these results with respect to colours may have been affected with the particular parcels of wool I used, and different results might have been obtained had other parcels been used, I do not place much confidence in them; yet, so far as I could discover, each parcel was equal in thickness, hardness, and in fact in every respect except that of colour.

Bodies in the state of powder, placed on the raised board, formed a third class of substances. These were black-lead, charcoal, whiting, chalk, lamp-black and river-

sand. The lowest readings occurred on lamp-black; the next in order were chalk, whiting, charcoal, black-lead and sand; a quantity of the last-mentioned substance was also placed on the ground to the depth of three inches, and to an extent of nine square feet; the difference between the mean readings of thermometers placed on sand in these two positions is probably accidental, arising from the observations in the former case having been taken on very fine nights only.

Building materials formed a fourth class; these consisted of glass, stone, brick, pantile, wood and slate. The lowest readings occurred on glass, and therefore this substance exhibited the greatest radiating power; the next in order were wood, slate, pantile, brick and stone successively; the three last-named substances were nearly equal.

Metals formed a fifth class; these consisted of tinfoil, lead, zinc, copper, iron, white tin, blackened tin, and the thermometer placed in the focus of a polished metallic reflector; of these lead and zinc of different thicknesses were experimented upon, and the same results were obtained (see Table XLVII.), from which circumstance it is inferred that the thickness of a metal has no effect on its radiating power. The metals were all placed on grass, and from the circumstance of the ready passage of heat from one part of a metal to another, much heat must have passed from the earth to their upper surface when so placed. The lowest readings of this class were those of the thermometer in the focus of the reflector; the next in order, and very nearly equal to it in amount, was copper, then blackened tin, lead, zinc, iron and white tin. Two of these metals, viz. lead and zinc, were placed at different distances from the earth, the plane of each sheet being parallel to the horizon in all cases, and in every individual experiment the same result was obtained as that exhibited in the means, viz. that a metal when raised above the ground, though only by one inch, was always warmer than one on the grass, though in the latter case, from its great conducting power for heat, some must have been received from the earth, whilst in the former case, heat only could have been derived from the air flowing past both its under as well as its upper surface.

The temperature of metals as exhibited in these results, contrary to what was expected, is much below that of the surrounding air; this is particularly the case with copper; this metal radiates heat so freely, that with respect to its amount, it would be placed in the second class of substances. Many simultaneous experiments were made with copper when placed on one of the angles of the box, within which was placed the thermometer in the parabolic reflector, with the readings of the latter thermometer; thus situated, the thermometer in the box was protected from lateral wind, whilst that on the copper was subject to the passing air; and thus situated the readings on the copper were lower than those in the reflector, except at times when the air was passing quickly.

Whilst speaking of metals, I may remark here that I never found the reading of a thermometer placed on a metal which had been moved successively from one part of

the grass plat to another, was lower than when it was placed on a similar piece of metal which had remained unmoved.

A piece of metal, if so placed that part of it be in contact with grass and the other part not, that part of it in contact with the grass will be at a lower temperature than that which is not in contact.

The thermometer whose bulb is in the focus of the mirror when the clouds are low remains stationary and frequently reads higher than any other thermometer however placed; the reason seems to be, that the heat radiated from the cloud being received on the reflector and reflected to the bulb in the focus, exceeds that radiated from the thermometer.

The remaining results in Table XLV. are from experiments on garden mould, gravel, saw-dust and paper; also from those made by placing the bulb of a thermometer nine inches above wood, and protected from lateral wind by wood one foot high, at the distance of nine inches from the bulb all round; and from those made by placing the bulb of a thermometer a quarter of an inch above water. Of these, paper exhibited the greatest cold; and from many unrecorded experiments, it always exhibited a great degree of cold. The next in order were saw-dust, garden mould, nine inches above wood, a quarter of an inch above water, and lastly gravel; this last-mentioned substance apparently exhibited the lowest radiating power of any substance contained in this class; but the circumstance of thermometers placed on garden mould and on gravel reading higher than when placed on other substances, was found to be in consequence of the observations having always been made on the ground, of which they formed a part, and the respective surfaces of which were readily supplied with heat from beneath, and thus prevented from exhibiting a great degree of cold from their situation and not from the nature of their substance. This was proved from the circumstance that small parcels of garden mould and gravel placed on the raised board, in which situation but little heat passed from the board to their surface, were found in a few nights to exhibit very low readings of thermometers placed on them. After having found this, I placed a thermometer with its bulb one inch below the surface of the garden mould, and at the same time another one inch below the surface of the ground under grass, and I found that the readings of the latter were usually some degrees higher than those of the former at times when the sky had been clear for some time, plainly indicating the cause of the higher readings on the surface of the mould to be the very ready passage of the heat from beneath to its surface; and, therefore, as before observed, arising from its situation and not from a property inherent in itself. I made no experiments on the amount of heat thus conducted to the surface of the mould and of gravel, but it evidently must be equal, or very nearly so, to the amount radiated from those substances. I made some experiments on the quantity and on the rapidity of heat conducted upwards from one inch below the surface of the ground under grass; these were made by placing thermometers with their bulbs one inch below the ground, on the surface of

the ground immediately under others placed on the top of long and short grass; all the observations thus taken have been copied out, and the difference between every consecutive pair of observations has been consulted with respect to the interval of time between them. The results of this investigation are contained in the following tables :—

Table XLVI.

Showing the quantity and the rapidity of heat conducted from one inch below the surface of the soil, to the surface and to the top of grass.

Year, month and day.	Mean reading of a thermometer in air at the height of four feet.	Long grass. Amount by which the reading of a thermometer read less when placed: On the top of long grass than that in air at the height of four feet.	Long grass. Amount by which the reading of a thermometer read less when placed: On the top of long grass than that on the surface of ground under long grass.	Short grass. Amount by which the reading of a thermometer read less when placed: On the top of short grass than that in air at the height of four feet.	Short grass. Amount by which the reading of a thermometer read less when placed: On the top of short grass than that under short grass.	Short grass. Amount by which the reading of a thermometer read less when placed: Under short grass than that one inch beneath the surface of ground.	Short grass. Amount by which the reading of a thermometer read less when placed: On the top of short grass than that one inch below the surface immediately under.	The decrease per hour in the reading of a thermometer placed: On the surface of ground under long grass.	The decrease per hour in the reading of a thermometer placed: On the surface of ground under short grass.	The decrease per hour in the reading of a thermometer placed: One inch below the surface of ground under short grass.	Number of hours during which the readings were frequently examined and from which the results were deduced. Long grass.	Number of hours during which the readings were frequently examined and from which the results were deduced. Short grass.
	°	°	°	°	°	°	°	°	°	°	h	h
1843, Dec. 11.	40·0	8·2	10·0	7·4	7·2	3·7	10·9	0·5	0·8	0·6	6	5
14.	44·9	6·0	3·4	5·6	2·6	1·5	4·1	0·3	0·4	0·7	2	2
15.	45·7	5·3	3·5	5·2	1·8	1·2	3·0	0·3	1·3	0·7	13	1
15.	45·7	...	...	...	...	...	...	...	0·6	0·4	...	4
17.	43·3	7·7	7·2	6·8	4·9	2·4	7·3	0·2	0·3	0·4	10	10
1844, Jan. 6.	43·5	...	...	5·1	1·9	3·4	5·3	...	1·0	1·0	...	2
22.	35·9	10·0	7·5	8·9	7·2	1·8	9·0	1·1	1·2	0·6	2	3
26.	42·7	9·8	4·5	7·4	1·5	3·3	4·8	0·3	0·6	0·8	2	2
30.	44·9	8·4	5·5	6·6	1·5	1·4	2·9	0·5	...	1·1	1	1
Feb. 1.	31·7	7·2	9·2	5·5	6·9	2·1	9·0	0·4	0·4	0·4	6	6
15.	34·6	10·6	11·5	7·7	7·3	2·9	10·2	0·4	0·1	0·4	4	4
16.	39·6	8·7	7·0	8·0	4·9	1·2	6·1	0·7	0·5	0·8	6	5
20.	33·4	...	...	6·7	6·5	3·0	9·5	...	1·1	0·3	...	3
22.	25·8	7·5	13·7	6·1	10·9	2·1	13·0	0·3	0·2	0·2	12	12
28.	35·0	6·2	8·0	...	...	...	...	0·3	...	...	7	
March 20.	30·8	8·4	12·8	...	...	...	...	0·3	...	...	9	
21.	37·6	10·8	9·2	...	...	...	...	0·4	...	...	2	
23.	39·7	12·5	11·4	...	...	...	...	0·3	...	...	1	
April 1.	42·0	9·7	11·1	8·4	5·8	5·4	11·2	0·6	0·3	0·2	10	8
2.	49·2	9·7	8·4	8·2	5·4	3·8	9·2	1·8	1·0	1·2	4	4
3.	47·0	11·4	8·8	9·5	2·5	3·3	5·8	0·4	0·1	0·6	11	6
8.	44·9	13·0	8·3	11·2	6·8	3·4	10·2	0·6	0·4	0·8	10	7
9.	52·6	13·0	9·2	11·2	3·6	5·3	8·9	0·8	1·0	1·0	1	1
17.	46·5	9·4	7·5	9·0	4·0	5·5	9·5	0·4	0·3	0·4	6	8
18.	49·1	11·9	12·4	...	...	...	...	0·7	...	...	9	
23.	54·7	7·3	5·5	7·0	3·0	2·7	5·7	1·2	0·8	1·6	2	1
24.	45·5	15·0	13·7	12·8	5·4	7·7	13·1	1·0	1·2	0·3	3	3
25.	50·2	10·0	9·2	9·1	4·0	6·0	10·0	2·0	2·0	1·5	12	10
27.	47·0	...	...	9·0	9·9	6·3	16·2	...	2·1	2·2	...	2
29.	40·8	8·3	5·8	7·3	7·8	1·9	9·7	1·2	0·6	0·2	2	4
May 1.	46·0	11·4	11·0	9·9	5·8	6·1	11·9	1·2	1·2	1·2	10	9

By taking the mean of the numbers in each column, we find that—

The mean reading of a thermometer placed on long grass was less than that in air by . . . . . 9·5°

The mean reading of a thermometer placed on short grass was less than that in air by . . . . . 8·0

The mean reading of a thermometer placed on long grass was less than that under long grass by . . . . . 8·7

The mean reading of a thermometer placed on short grass was less than that under short grass by . . . . . 5°·2
The mean reading of a thermometer placed under short grass was less than that one inch below the surface of the ground under short grass by . . 3·5
The mean reading of a thermometer placed on short grass was less than that one inch below the surface of the ground under short grass by . . . . 8·7
The mean rate of decrease in the reading of a thermometer placed under long grass was, per hour . . . . . 0·7
The mean rate of decrease in the reading of a thermometer placed under short grass was, per hour . . . . . 0·8
And the mean rate of decrease in the reading of a thermometer placed one inch below the surface under short grass was, per hour . . . . . 0·75

In this investigation the excess of the reading of a thermometer placed one inch below the surface of the ground under long grass, above that placed on the surface of the ground, has not been deduced; from a few experiments it appeared to be exactly the same as that of short grass; and assuming such to be the case, the mean difference on clear and calm nights between the reading of two thermometers, the one placed on long grass and the other placed one inch below the ground immediately underneath the other, was 13°·0; and the same difference with respect to short grass was 11°·5. As the results contained in this table were deduced from observations taken at times when the temperature of the long grass was above 30° generally, and occasionally a little below 30°; and as it appears from the remarks following Table XLV. that at temperatures much below 30° very great differences occurred with grass of different lengths, it was desirable to investigate observations similar to the above at low temperatures: such observations I took only on one night, viz. that of March 13, 1845; during this night the thermometers were read hourly for eight hours, and during the time—

The mean reading of the thermometer in air at the height of four feet was . 15°·1
The mean reading of the thermometer on long grass was . . . . . 5·6
The mean reading of the thermometer on the surface of the soil under long grass was . . . . . 26·9
The mean reading of the thermometer one inch beneath the surface of the ground under long grass was . . . . . 33·1
The mean reading of the thermometer on short grass was . . . . . 11·1
The mean reading of the thermometer on the surface of the ground under short grass was . . . . . 21·4
The mean reading of the thermometer one inch beneath the surface of the ground under short grass was . . . . . 28·2

The results of these experiments exhibit in a marked manner the badness of the conducting power of grass for heat, the reading on long grass being less than that on

the surface of the ground immediately beneath it by 21°·3, and less than that one inch below the surface by 27°·5; and the reading of that on short grass was less than that on the ground immediately beneath it by 10°·3, and less than that one inch beneath the surface of the ground by 17°·1. The mean rate of decrease of temperature at one inch beneath the surface of the ground under long grass was 0°·2 per hour, and under short grass was 0°·3 per hour; and on the surface of the ground under short grass was 0°·4 per hour. The difference between the readings at one inch beneath the surface under long grass and under short grass was 4°·9, the former being the higher by this amount; the difference between the readings on the surface of the soil under long grass and under short grass was 5°·4, that under long grass being the higher of the two; and the difference of readings on long grass and on short grass was 5°·4, that on long grass being the lower of the two; and thus the reading on long grass was as much less than that on short grass as that under long exceeded that under short: this circumstance affords a sufficient reason for the temperature of short grass being warmer than that of long grass, the heat passing so much more freely from the earth to it than in the case of long grass.

I shall conclude this part of this section, with remarking that the various amounts of dew deposited, at the same time, on different bodies at night, were found to be, as near as could be determined, proportional to the amounts of the depression of their temperature below that of the dew-point. Hence, it is evident that all hygrometers formed of any of these substances, or of any animal or vegetable substance, when exposed to the clear sky at night, will be cooled by the radiation of their heat, and will cool the air in contact with them; and thus indicate a greater degree of humidity than actually exists; and particularly so, should their temperatures descend below that of the dew-point, and dew be actually deposited upon them.

The following table contains the results of special simultaneous observations, made in some cases in consequence of the results as deduced from the ordinary observations not agreeing with each other, and in others to determine the amount of the correction due to the placing of the different substances on the raised board.

Table XLVII.—Results of Special Simultaneous Observations.

Excess of the reading of the thermometer in air at the height of four feet protected from the effects of radiation, above those of thermometers, in simultaneous observations, placed

1843. Day, hour and minute.	One inch above grass.	Two inches above grass.	1843. Day, hour and minute.	On white unwrought cotton wool. On grass.	On the raised board.
Sept. h m	°	°	Sept. h m	°	°
13. 12 0	12·0	7·5	13. 13 30	11·7	11·8
13. 12 30	12·3	6·8	13. 14 30	11·5	10·0
13. 13 20	11·7	5·7	13. 15 15	12·3	10·0
13. 14 30	10·5	5·2	13. 15 20	9·5	8·3
13. 15 15	10·3	5·3	13. 15 24	6·0	5·5
13. 15 20	8·5	4·5	13. 15 37	4·5	4·5
13. 15 24	6·0	3·5	13. 17 20	5·5	5·5
13. 15 37	4·5	3·0	Oct. 25. 5 15	13·4	14·5
13. 17 20	5·5	3·5	25. 8 0	11·6	10·3
			25. 9 30	13·0	11·7
			25. 11 40	10·8	11·0
			25. 13 0	9·5	10·2
			25. 15 0	8·9	9·9
			25. 18 15	9·0	8·8
			25. 19 30	7·5	6·2
			25. 21 0	6·1	2·6

1843. Day, hour and minute.	On flax. On grass.	On the raised board.
Nov. h m	°	°
7. 10 0	6·5	5·5
7. 11 10	6·5	4·3
8. 9 10	8·0	5·8
8. 11 0	8·6	6·1
11. 5 30	8·3	8·3
11. 7 30	13·2	10·2
11. 9 50	9·5	7·5
11. 10 35	10·5	7·4
11. 11 10	13·3	9·7
11. 12 0	9·5	7·5
12. 4 0	5·9	4·3

1843. Day, hour and minute.	On sand. On the ground.	On the raised board.
Sept. h m	°	°
13. 12 0	7·5	7·5
13. 12 30	7·8	8·3
13. 13 30	9·2	8·9
13. 14 30	8·2	7·5
13. 15 15	8·8	8·3
13. 15 20	7·0	5·0
13. 15 24	6·0	5·0
13. 15 37	4·5	4·0
13. 17 20	5·5	4·5
15. 7 20	3·2	2·2
15. 9 10	3·5	5·3
15. 10 33	5·0	7·3
15. 11 0	5·3	6·8
16. 7 40	4·0	3·4
16. 9 10	3·6	4·8
16. 11 0	3·2	3·5
17. 11 0	3·3	3·8
17. 11 30	4·2	4·3
17. 12 30	3·6	4·2
17. 13 20	3·4	3·3
17. 15 20	2·8	2·7
17. 17 20	2·9	2·6
18. 7 30	4·0	3·8
18. 8 0	4·1	3·9
18. 9 0	8·0	6·0

1843. Day, hour and minute.	On zinc. Thin.	Moderately thick.	Thick.
Nov. h m	°	°	°
29. 12 30	5·7	4·3	3·0
29. 13 45	5·7	6·0	6·0
29. 15 0	5·3	5·5	5·8
29. 17 0	1·8	3·9	3·8
29. 18 0	2·5	3·9	3·7
29. 19 0	4·0	4·7	4·5
Dec. 2. 3 40	3·6	3·3	3·0
2. 4 30	4·7	4·5	4·0
5. 16 15	7·2	6·7	6·9
5. 17 30	5·6	5·3	5·3
5. 19 30	5·8	5·5	5·8
5. 21 0	4·5	4·7	4·3
6. 3 45	4·6	4·1	4·2
6. 4 15	5·3	5·2	5·0
6. 4 45	5·9	5·7	5·9
6. 11 0	3·2	3·2	4·2
6. 14 0	5·0	4·5	4·8
8. 4 30	9·1	8·1	9·1
8. 9 30	8·5	8·5	8·3
11. 3 55	7·0	6·8	6·8
11. 4 30	7·2	7·2	7·2
11. 5 30	5·4	6·0	6·1
11. 6 30	4·8	4·8	4·8
11. 9 30	5·6	5·2	5·2
13. 18 0	3·5	3·5	3·2
14. 3 0	3·9	3·7	3·7
14. 4 0	4·3	4·5	4·5
14. 5 0	4·2	4·2	4·2
15. 3 45	3·2	3·5	3·1
15. 5 0	4·0	3·8	3·8
17. 4 0	5·5	5·5	5·5

1843. Day, hour and minute.	On stone. Fire.	Portland.	Purbeck.
Dec. h m	°	°	°
11. 4 30	2·2	2·4	2·7
11. 5 30	2·5	2·9	3·1
11. 6 30	3·0	4·0	3·0
11. 9 30	2·3	2·6	1·9
13. 18 0	3·0	2·5	2·0
14. 3 0	2·2	2·4	1·9
14. 4 0	2·5	2·6	2·5
14. 5 0	2·6	2·9	2·2
15. 3 45	1·9	1·7	1·7
15. 5 0	2·9	2·6	2·9
15. 21 0	3·0	3·8	2·8
17. 4 0	2·2	3·2	3·2
1844.			
Jan. 17. 5 0	4·3	3·5	3·4
26. 5 10	5·3	4·8	5·0
26. 7 30	4·7	4·1	4·5
30. 4 30	5·3	4·0	4·6
30. 5 30	3·5	2·6	3·1
Feb. 1. 3 30	2·7	2·7	2·4
1. 5 0	4·5	6·0	4·0
1. 7 0	0·5	2·0	4·2
1. 9 0	2·7	2·0	2·7
15. 15 0	4·3	4·3	4·6
15. 17 30	2·8	2·8	5·0
15. 18 30	2·5	1·5	4·5
15. 19 15	3·8	3·3	6·0
16. 4 30	4·5	4·7	5·7
16. 5 30	5·0	5·0	5·8
16. 7 0	4·4	4·7	5·4
16. 8 0	3·5	3·3	4·0
16. 9 0	4·6	4·0	5·1
20. 5 0	4·5	4·9	4·7

1844. Day, hour and minute.	On lead. On grass.	Six inches above grass.
Feb. h m	°	°
1. 5 0	3·3	4·5
1. 7 0	3·8	4·0
1. 9 0	3·7	4·7
15. 15 0	6·3	5·0
15. 17 30	7·5	4·9
15. 18 30	7·3	6·3
15. 19 15	6·5	5·0
16. 4 30	7·7	4·5
16. 5 30	10·0	7·0
16. 7 0	5·7	3·2
16. 8 0	5·5	2·5
16. 9 0	6·3	2·8

	One foot high.	Three feet high.
May h m	°	°
1. 15 0	6·7	5·7
1. 17 0	4·2	4·8

1844. Day, hour and minute.	In air. Height in feet. 6.	10.	15.
Feb. h m	°	°	°
21. 11 0	0·0	0·1	0·2
22. 6 45	1·2	1·3	1·3
22. 9 0	0·8	0·8	0·1
22. 11 30	2·4	2·1	2·4
22. 12 30	0·8	0·8	0·8
22. 13 0	1·3	1·3	1·6
22. 14 30	0·9	0·8	1·0
22. 16 0	0·6	0·8	0·7
22. 17 30	0·2	−0·1	0·1
22. 18 45	−0·1	0·0	0·0

TABLE XLVIII. Abstract of Special Simultaneous Observations.

Situation of the thermometer.	Excess of air-temperature above the reading of thermometer.	Number of simultaneous observations.	Remarks.
One inch above grass	5·0	9	The observations at the height of two inches were made on one night only.
Two inches above grass	5·0		
On white unwrought cotton wool { on grass	9·4	16	It would seem that the amount of radiation from the raised board was less than that from the same substance on the ground.
on the raised board	8·8		
On flax { on grass	9·0	11	The amount of radiation from flax on the raised board decidedly the smaller.
on the raised board	6·9		
On sand { on the ground	5·6	25	The sand on the board was a small quantity, whilst that on the ground was a large quantity; the amount of radiation from sand on the raised board was the smaller.
on the raised board	5·1		
On zinc { thin	5·1	31	From these it would appear that the thickness of a metal has no influence on the amount of its radiating power.
moderately thick	5·0		
thick	5·1		
On firestone	3·3	31	The circumstance of Purbeck stone having a result larger than the other two is probably accidental, as on many nights its results were less than those of the other stones.
On Purbeck stone	3·7		
On Portland stone	3·3		
On lead on grass	6·5	12	The increase in the readings of a thermometer placed on a metal, raised in the air, is decided.
On lead six inches above grass placed horizontally	4·5		
In air at eight feet high	0·8	10	The results are identical, and therefore in Table XLV. such should be the case in the mean.
In air at ten feet high	0·8		The observations at ten feet were made on one night only.
In air at twelve feet high	0·8		
On lead one foot high	5·5	2	The increase in the readings of a thermometer with height is indicated.
On lead three feet high	5·3		

The remarks in the last column indicate the results of the experiments; those relating to the different readings of a thermometer when placed on the same substance on the raised board and on the grass, seem to exhibit in a decided manner that more heat had passed from the board to the surface of the substance than had passed from the grass to it, causing the reading of the thermometers to be increased; the amount of this increase appears to be about half a degree, and this amount should be applied subtractively to all readings on substances placed on the raised board, or additively to all differences between their readings and those in air at the height of four feet.

In Table XLV. the results from all substances in powder were deduced from observations on the raised board, and from this investigation all these results should be increased by half a degree; in the same table the results from blue and yellow jeweller's wool and from raw silk exhibit a greater degree of cold on the raised board than when they were on grass; but these substances were never observed simultaneously in both positions, and they were only placed on the raised board on the finest and calmest nights, and in this latter position they require the same correction to be applied to them as it is necessary to apply to the other substances, whose results are deduced from observations taken on the raised board alone.

Table XLIX.

Observations connected with Snow.

1844. Day, hour and minute.	Reading of thermometer in air at four feet high protected from radiation.	Excess of the reading of a thermometer placed in air at the height of four feet and protected from the effects of radiation, above that of a thermometer fully exposed to the sky, and placed: On long grass clear of snow.	On long grass covered by snow.	On short grass clear of snow.	On short grass covered by snow.	On surface of ground under short grass clear of snow.	On surface of ground under long grass clear of snow.	One inch below surface of ground under grass covered by snow.	On grass cleared of snow covered by glass free of snow one inch high.	On grass clear of snow covered by white tin one inch high.	On snow.	On raw wool on snow.	On flax on snow.	In focus of metallic reflector cleared of snow.	Nine inches above wood cleared of snow.	One foot above snow.	Two feet above snow.	On lead six inches high cleared of snow.	On copper on snow.	On zinc on snow.	On zinc on grass cleared of snow.	On Purbeck stone cleared of snow.	On glass on snow.	On glass one inch high cleared of snow.	On white tin on snow.	On black tin on snow.	Clouds. Modification.	Amount 0–10.	Wind. High or low.	Direction.	Strength 0–6.	Haze, fog, mist, or vapour.	Remarks.
Feb.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°						
4. 15	0 31·6	7·6	...	5·4	...	...	...	...	...	...	...	9·8	9·8	9·3	...	1·8	1·9	...	...	...	...	...	...	...	4·8	9·0	Clear	...	...	...	...	H.	Snow to the depth of three inches was on the ground.
4. 19	0 29·7	6·5	...	5·1	...	...	...	...	...	...	...	8·1	8·0	8·7	...	2·3	2·7	...	...	...	...	...	...	...	3·5	7·5	Cirro-stratus	9	...	c.	...	...	
5. 5	0 31·0	8·0	−2·0	6·4	−2·7	1·8	...	−5·5	...	...	5·0	7·0	6·5	9·9	...	1·7	1·7	...	...	5·2	...	...	6·8	7·8	7·8	9·7	Clear	...	...	...	...	H.	
5. 7	25 29·0	9·2	−3·0	9·6	−2·8	−1·8	...	−5·3	4·2	...	6·8	8·2	9·2	10·9	...	2·0	2·0	6·2	...	6·0	...	...	10·4	5·6	7·8	8·8	Flying clouds	3	...	...	...	H.	
6. 11	0 33·1	5·1	1·1	5·9	2·6	2·6	0·1	−1·9	1·6	3·6	2·6	7·6	8·0	7·6	2·1	0·9	0·9	...	5·1	3·9	3·6	2·6	5·6	4·0	5·6	6·1	Cirro-stratus	9½	H.	c.	...	...	

By taking the mean of the numbers in each column, the following results are obtained:—

Table L. Experiments connected with Snow.

Situation of the thermometer, its bulb, or the substance under which it was placed being fully exposed to the sky.	Mean excess of the reading of the thermometer in air at the height of four feet, protected from radiation.	Number of comparisons.
	°	
On long grass clear of snow	7·3	5
On long grass covered by snow	−1·3	3
On short grass clear of snow	5·5	5
On short grass covered by snow	−1·0	3
On surface of ground under short grass clear of snow	0·9	3
On surface of ground under long grass clear of snow	0·1	1
One inch below surface of ground under long grass covered by snow	−4·2	3
On grass cleared of snow covered by glass free from snow one inch high	2·9	2
On grass clear of snow covered by white tin one inch high	3·6	1
On snow	4·8	3
On raw wool on snow	8·2	5
On flax on snow	8·3	5
In focus of metallic reflector cleared of snow	9·3	5
Nine inches above wood cleared of snow	2·1	1
One foot above snow	1·7	5
Two feet above snow	1·8	5
On lead six inches high cleared of snow	6·2	1
On copper on snow	5·1	1
On zinc on snow	5·0	3
On zinc on grass cleared of snow	3·6	1
On Purbeck stone cleared of snow	2·6	1
On glass on snow	7·6	3
On glass one inch high cleared of snow	5·8	3
On white tin on snow	5·9	5
On blackened tin on snow	8·2	5

At the time of two of these five sets of observations the sky was nearly covered with cloud; at one other time one-third part of the sky was clouded over and much haze prevailed; and at the remaining times the sky was not bright, and there was a perceptible haze. The mean temperature of the air was 30°·9; the mean reading of the thermometer on long grass clear of snow was 1°·8 less than that on short grass, also clear of snow; and the readings were nearly alike when the two were covered with snow. The effects of snow on long grass was to cause the thermometers on the grass to read higher by 8°·6, but this difference does not fully represent the non-conducting power of snow, as the temperature of the air varied very little whilst these experiments were being made; had the temperature of the air fallen or risen much whilst the snow had been on the ground, the temperature of the earth under the snow would have continued nearly at the same reading, and in that case the effects of the snow would have been much more decided. The next favourable opportunity I had of repeating my experiments on snow was 1845, February 12*. Snow had previously fallen to the depth of three inches, and during the night, which was cloudless, the reading of a thermometer which was placed on long grass was −6°, whilst that covered by snow was 28°·0; the effect of the snow was therefore to keep the grass warmer by 34°, and therefore vegetation was kept warmer by this amount than it would have been had there been no snow. The reading of a thermometer placed on the snow was −12°, and the difference between the readings of two thermometers, the one placed on snow and the other under the snow, was 40°. After this time the reading on grass clear of snow rose to 24°, and that on snow increased to 15°, without causing any variation in the reading of that under the snow, which still read 28°. Snow would therefore appear to be a very perfect non-conductor of heat. The lowest reading of a thermometer on flax was $-12°\frac{1}{2}$; that on short grass was 5°, being 11° higher than that on long grass; this heat (see remarks following Table XLV.) represents the difference between the quantities of heat conducted from beneath the surface to long and to short grass, and it would represent also the greater quantity of heat lost from the earth as covered by short grass than that by long grass; and if to this 11° we add the heat conducted beneath the surface to long grass, which did not differ much from 6°, it would appear that heat to the amount of 17° was conducted to the short grass from the earth beneath it. Snow being so perfect a non-conductor of heat, evidently prevents to a high degree the loss of heat by radiation from bodies covered by it; and it also prevents the loss of heat from such bodies by conduction, at times when the temperature of the air is lower than they are. Raw wool, flax, straw, and other bodies which are bad conductors of heat, act in a similar way and prevent the injurious effects of cold to bodies covered by them, to which injurious effects vegetation is liable in this climate in every month of the year, as it is liable to a temperature at night below the freezing-point of water in every month.

* For these observations, see the Greenwich Magnetical and Meteorological volume for the year 1845, pages 256 and 257.

Section II.—*Results of Observations made by Self-registering Minimum Thermometers.*

These observations extend over a period of time of nearly four years' duration, viz. from 1841 February to the end of 1844*.

The observations consist of the daily reading of a self-registering minimum thermometer with its bulb placed at the height of four feet above the ground, protected from the effects of radiation and rain, but in other respects freely exposed to the air, and the daily reading of a similar thermometer placed with its bulb in the focus of a metallic parabolic reflector, and fully exposed to the sky.

The kind and average amount of cloud by which the sky was covered were also noted every night. The average direction and strength of the wind were also determined every night.

From 1843 April and extending to the end of 1844, several similar thermometers were placed on or near different substances, and their readings were taken daily.

The first process in the reduction of the observations was the taking the difference between the reading of the thermometer in air and the simultaneous reading of every other thermometer.

The second process was the forming all those differences into groups, according to the variable state of the sky, depending only on the kind and amount of cloud, but independently of its height. The result of this investigation was found to be that the amount of the difference varied with every variation of the amount of the clouds.

The third process was the forming groups of the differences derived from the same cloudy state of the sky, but with the clouds at different distances from the earth. The result was found to be that the amount of the numbers was different according to the variable distance that the clouds were from the earth.

The fourth step was the forming groups of numbers derived from observations on different nights with the same state of the sky, but with the wind blowing from different quarters, independently of its strength. The result of this investigation was that no certain difference existed depending on the quarter from whence the wind blew.

The fifth step was the forming groups of the numbers found from observations on different nights with the same state of the sky, on calm nights, and on nights when the wind has been blowing strongly, at times amounting to a gale, independently of its direction. The result was found to be that no certain difference existed, depending on the strength or velocity of the wind, showing clearly that on every windy night a portion of time had been calm of sufficient duration for the instruments to register the loss of heat by radiation, and to the same amount as would have been shown had the air been in a calm state during the night.

Having thus explained the manner in which the preliminary steps in the reduction

* The observations are placed in the Archives of the Royal Society.

of the observations have been made, I shall proceed with the explanation of the process for the formation of the following tables.

As the variations of the excess of the readings of the thermometer in the air, above those otherwise placed, were thus found to depend on the variations in the amount and in the height of the clouds only, the next operation was dividing the results of each month's observations into five groups as follow.

The first group was formed from the observations taken on nights which were cloudy throughout.

The second group from those taken on nights which were principally cloudy, but the clouds frequently broken.

The third group from those taken on nights which were half-clear and half-cloudy.

The fourth group from those taken on nights which were principally cloudless, but yet clouds were frequent.

The fifth group from those taken on cloudless nights, and in this way Tables LI. to XCIX. were formed; the successive results in each class being arranged according to their dates of occurrence.

The examination of the columns in each month as to the distribution of the numbers, gives a good knowledge of the distribution of the clouds at night during the month.

Excess of the reading of a self-registering minimum thermometer placed in air at the height of four feet, protected from the effects of radiation, above that of a similar thermometer placed in the focus of a metallic parabolic reflector fully exposed to the sky on every night, arranged according to the state of the sky with respect to the quantity of clouds.

Number of the Tables.	1841. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LI.	Feb.	4 21	4·8	24 21	3·8	17 21	.....	.....	.....	19 21	5·8
		5 21	3·0	28 21	4·1	18 21	3·2				
		6 21	0·8								
		7 21	2·8								
		8 21	2·3								
		9 21	2·8								
		10 21	5·7								
		11 21	1·9								
		12 21	1·7								
		13 21	0·8								
		14 21	−0·6								
		15 21	1·2								
		16 21	2·9								
		20 21	2·3								
		21 21	2·1								
		22 21	1·1								
		23 21	1·5								
		25 21	2·4								
		27 21	1·3								
LII.	March	13 21	−0·5	1 21	1·8	7 21	5·8	2 21	5·2	6 21	9·4
				4 21	2·1	9 21	5·3	3 21	4·9	8 21	7·2
		30 21	2·0	20 21	3·5	14 21	4·2	5 21	5·1	10 21	4·7
		31 21	0·2	23 21	4·0	22 21	4·3	17 21	9·7	11 21	7·0
				28 21	4·4	26 21	5·9	18 21	5·4	12 21	5·3
										15 21	8·8
										16 21	13·4
										19 21	6·7
										24 21	7·3
										25 21	6·9
										27 21	5·7
										29 21	2·7
LIII.	April	10 21	2·1	1 21	3·5	5 21	4·5	14 21	7·2	2 21	8·6
		13 21	2·8	6 21	2·7	9 21	4·7	21 21	3·5	3 21	7·8
		22 21	0·7	7 21	1·9	12 21	6·6	23 21	6·5	4 21	11·5
		24 21	2·1	11 21	1·3	19 21	7·9	26 21	5·6	8 21	11·8
				18 21	(−2·4)	20 21	4·7	28 21	5·6	15 21	7·6
				25 21	6·3	27 21	5·4	29 21	6·2	16 21	10·2
										30 21	8·1

Table (Continued).

Number of the Tables.	1841. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LIV.	May	2 21	0·2	5 21	3·9	10 21	5·3	24 21	6·6	1 21	7·7
		3 21	0·1	6 21	3·2	16 21	5·5	28 21	5·4	12 21	8·5
		4 21	−0·1	7 21	−0·4	17 21	5·4	30 21	7·5	13 21	7·8
		21 21	0·2	8 21	2·5	19 21	3·7	31 21	8·4	14 21	7·5
		25 21	0·6	9 21	1·1	22 21	5·5	.....	.....	15 21	8·0
		29 21	1·5	11 21	3·5	23 21	5·4	.....	.....	20 21	5·9
				18 21	0·5	.....	.....	.....	.....	26 21	5·3
				27 21	2·1						
LV.	June	5 11	−0·7	2 21	2·3	4 21	7·9	1 21	5·9	3 21	9·2
		7 21	−1·1	6 21	5·6	16 21	5·1	10 21	7·8	9 21	9·4
		8 21	0·8	14 21	3·7	19 21	4·9	13 21	6·7	12 21	11·2
		11 21	−0·4	.....	.....	21 21	4·9	15 21	8·3	20 21	3·5
		18 21	1·4	28 21	1·9	22 21	4·6	17 21	9·4	26 21	(−0·3)
		24 21	.....	30 21	3·5	25 21	(−0·3)	23 21	6·2		
		27 21	0·6	.....	.....	29 21	4·5				
LVI.	July	1 21	−0·3	4 21	3·6	12 21	5·3	4 21	7·0	3 21	10·9
		2 21	1·4	11 21	2·8	18 21	5·2	8 21	2·1	9 21	3·8
		3 21	1·3	14 21	1·9	24 21	4·6	13 21	4·9	16 21	8·0
		7 21	−0·3	19 21	3·1	28 21	4·1	.....	.....	17 21	6·8
		10 21	0·3	20 21	3·6	29 21	4·7				
		15 21	1·5	21 21	2·9	30 21	4·2				
		23 21	1·7	22 21	2·3						
				25 21	2·1						
				26 21	3·4						
				27 21	3·7						
				31 21	2·2						
LVII.	August	1 21	0·1	4 21	5·0	6 21	7·9	9 21	3·3	20 21	7·0
		2 21	−0·6	5 21	3·5	11 21	4·5	15 21	6·5	24 21	10·5
		3 21	−1·3	7 21	3·8	12 21	6·5	18 21	6·4	28 21	8·2
		10 21	0·5	8 21	3·0	14 21	5·5	19 21	5·2	29 21	14·0
		17 21	1·8	13 21	2·5	23 21	5·1	21 21	6·2		
		22 21	0·3	16 21	3·9	30 21	5·0	27 21	6·0		
		25 21	1·6	26 21	3·2						
		31 21	2·2								
LVIII.	Sept.	4 21	2·9	27 21	4·0	3 21	8·4	1 21	6·7	6 21	4·5
		20 21	2·3	29 21	4·5	5 21	5·6	2 21	6·1	10 21	10·5
						7 21	5·3	13 21	3·6	12 21	11·7
						8 21	4·5	16 21	5·8	15 21	7·1
						9 21	4·8	.....	.....	17 21	7·1
						11 21	4·1	.....	.....	18 21	7·9
						14 21	5·5				
						19 21	4·1				
						21 21	3·3				
						22 21	4·3				
						23 21	4·7				
						24 21	5·2				
						25 21	4·3				
						26 21	2·7				
						28 21	4·0				
						30 21	4·1				

Table (Continued).

Number of the Tables.	1841. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LIX.	Oct.	27 21	0·6	1 21	3·6	6 21	2·4	15 21	7·0	16 21	8·2
		28 21	2·1	2 21	2·5	7 21	2·4	.....	.....	17 21	12·9
		29 21	2·7	3 21	1·0	8 21	3·9	.....	.....	19 21	6·7
		30 21	0·0	4 21	3·1	9 21	4·6	.....	.....	20 21	7·9
		31 21	2·1	5 21	3·1	12 21	4·8	.....	.....	21 21	7·9
				10 21	3·8	14 21	4·1				
				11 21	3·2	18 21	4·5				
				13 21	3·4	22 21	5·9				
				26 21	2·1	23 21	4·7				
						24 21	4·2				
						25 21	3·5				
LX.	Nov.	1 21	2·4	3 21	2·2	2 21	8·9	22 21	7·0	6 21	9·0
		21 21	2·0	4 21	−1·1	5 21	4·3	23 21	6·7	8 21	8·8
		27 21	2·7	7 21	4·1	10 21	5·7	26 21	7·9	11 21	9·4
				9 21	3·2	24 21	5·6	.....	.....	12 21	5·4
				13 21	0·9	25 21	5·7	.....	.....	14 21	8·2
				15 21	1·1	30 21	6·1	.....	.....	16 21	10·0
				20 21	2·4	.....	.....	.....	.....	17 21	9·2
				28 21	4·9	.....	.....	.....	.....	18 21	8·6
				29 21	5·0	.....	.....	.....	.....	19 21	3·6
LXI.	Dec.	19 21	4·5	2 21	5·3	1 21	5·1	3 21	6·9	6 21	8·2
		28 21	4·3	7 21	3·9	4 21	5·0	8 21	7·1	10 21	7·8
		29 21	4·2	12 21	4·0	5 21	5·9	16 21	8·0	14 21	8·9
				24 21	1·0	9 21	6·1	21 21	6·6	17 21	8·9
				25 21	3·7	11 21	5·9	23 21	6·7	18 21	11·8
				27 21	4·4	13 21	4·4	.....	.....	20 21	8·5
						15 21	5·8	.....	.....	26 21	6·5
						22 21	8·2				
						30 21	5·6				
LXII.	1842. Jan.	8 21	2·1	0 21	5·0	1 21	7·6	6 21	5·5	7 21	6·0
		9 21	2·5	2 21	2·7	3 21	8·7	12 21	7·8	14 21	9·1
		10 21	4·5	.....	.....	4 21	4·7	15 21	7·0	23 21	10·7
		11 21	1·8	.....	.....	5 21	4·5	16 21	4·9	24 21	10·7
		13 21	2·4	.....	.....	17 21	3·6	22 21	6·4	25 21	8·1
		18 21	2·0	.....	.....	28 21	6·6	26 21	5·5	27 21	12·0
		19 21	2·2	.....	.....	30 21	5·3	31 21	6·1		
		20 21	0·6								
		21 21	3·8								
		29 21	1·5								
LXIII.	Feb.	7 21	1·6	2 21	3·7	3 21	4·3	1 21	7·3	13 21	6·0
		11 21	1·0	4 21	3·3	5 21	5·0	6 21	5·7	15 21	8·9
		16 21	2·8	8 21	1·2	12 21	7·2	14 21	5·4	17 21	8·4
		23 21	1·4	9 21	2·5	20 21	6·4	18 21	5·0	25 21	9·3
		24 21	2·3	10 21	3·8	21 21	5·4	19 21	5·5		
				22 21	3·9	27 21	5·4				
						28 21	5·6				

TABLE (Continued).

Number of the Tables.	1842. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LXIV.	March	2 21	3·2	19 21	1·6	3 21	4·1	18 21	7·4	1 21	7·4
		7 21	1·4	.....	.....	5 21	4·9	22 21	5·6	4 21	4·1
		9 21	2·5	.....	.....	8 21	4·3	23 21	6·7	6 21	6·4
		14 21	0·5	.....	.....	11 21	4·1	.....	.....	10 21	8·2
		15 21	1·3	.....	.....	16 21	6·4	.....	.....	12 21	6·8
		24 21	2·5	.....	.....	17 21	4·5	.....	.....	13 21	6·5
		29 21	2·5	.....	.....	20 21	3·8	.....	.....	25 21	6·3
		31 21	1·6	.....	.....	21 21	3·6	.....	.....	26 21	6·3
						27 21	3·3				
						28 21	3·2				
						30 21	4·2				
LXV.	April	12 21	2·2	11 21	3·9	1 21	4·9	3 21	7·9	5 21	7·5
		13 21	0·9	.....	.....	2 21	4·9	4 21	7·7	8 21	4·4
		14 21	2·8	.....	.....	7 21	4·8	6 21	3·8	17 21	8·1
		18 21	0·7	.....	.....	9 21	4·6	15 21	3·7	19 21	5·6
		21 21	0·6	.....	.....	10 21	4·3	16 21	4·3	25 21	6·6
						22 21	4·6	20 21	2·5	26 21	7·0
						23 21	6·9	24 21	5·9	27 21	9·3
						29 21	3·7	.....	.....	28 21	7·6
										30 21	7·7
LXVI.	May	3 21	2·3	5 21	5·7	7 21	5·9	4 21	6·5	1 21	8·1
		11 21	1·7	6 21	1·6	14 21	4·4	8 21	6·7	2 21	7·1
		27 21	1·7	12 21	6·1	15 21	5·7	10 21	7·4	9 21	9·0
				20 21	5·3	18 21	7·7	16 21	6·9	13 21	7·6
				21 21	6·4	25 21	6·9	17 21	5·2	23 21	9·5
								19 21	6·6	28 21	8·4
								22 21	8·2	29 21	9·2
								24 21	6·8	31 21	8·7
								26 21	6·2		
								30 21	7·2		
LXVII.	June	25 21	2·4	24 21	5·8	14 21	5·2	1 21	8·3	2 21	9·7
		30 21	−0·1	.....	.....	16 21	6·5	4 21	6·5	3 21	8·9
						17 21	6·2	13 21	5·8	5 21	9·1
						18 21	6·2	15 21	6·7	6 21	15·6
						19 21	5·5	21 21	5·3	7 21	16·0
						20 21	5·8	27 21	5·7	8 21	7·9
						23 21	4·9	28 21	6·0	9 21	7·3
								29 21	7·0	10 21	6·4
										11 21	6·9
										12 21	7·2
										22 21	12·8
										26 21	14·2

Table (Continued).

Number of the Tables.	1842. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LXVIII.	July	7 21	5·9	18 21	4·4	1 21	5·2	2 21	5·7	13 21	10·2
		22 21	2·6	19 21	4·6	3 21	4·9	5 21	7·2	14 21	10·4
		27 21	2·6	28 21	2·3	4 21	2·5	6 21	8·0	15 21	7·9
						8 21	4·8	9 21	5·9	23 21	8·1
						11 21	5·1	10 21	6·1	24 21	9·0
						20 21	6·9	12 21	5·8	25 21	6·6
								16 21	5·6		
								17 21	8·1		
								21 21	6·7		
								26 21	4·4		
								29 21	6·1		
								30 21	7·1		
								31 21	7·3		
LXIX.	August	10 21	1·5	19 21	3·6	4 21	6·0	2 21	5·7	1 21	7·0
		24 21	2·8	.....	.....	5 21	4·5	12 21	5·5	3 21	3·4
		25 21	4·5	.....	.....	6 21	4·4	13 21	5·5	7 21	6·6
						18 21	7·8	26 21	6·2	8 21	7·4
						20 21	4·4	.....	.....	9 21	8·3
						22 21	5·5	.....	.....	11 21	6·7
						23 21	6·8	.....	.....	14 21	7·3
						27 21	4·3	.....	.....	15 21	7·2
						29 21	0·4	.....	.....	16 21	4·1
						30 21	5·2	.....	.....	17 21	3·3
						31 21	6·0	.....	.....	21 21	7·3
										28 21	−0·6
LXX.	Sept.	1 21	1·1	7 21	3·6	4 21	6·3	3 21	1·4	2 21	2·5
		11 21	3·2	8 21	4·8	9 21	5·2	5 21	8·0	14 21	6·4
		17 21	1·7	25 21	1·7	13 21	5·7	6 21	6·5	15 21	4·6
		23 21	2·3	26 21	0·5	16 21	1·0	10 21	6·1		
		24 21	1·7	.....	.....	18 21	3·9	12 21	6·6		
						22 21	0·1				
						27 21	5·7	19 21	5·0		
						28 21	4·4	20 21	6·1		
						30 21	5·7	21 21	4·6		
								29 21	6·8		
LXXI.	Oct.	9 21	3·4	12 21	5·0	8 21	4·9	1 21	4·0	2 21	7·0
		14 21	3·0	17 21	4·1	11 21	5·8	5 21	8·0	3 21	8·7
		15 21	3·2	27 21	4·8	13 21	9·7	6 21	8·8	4 21	10·1
		16 21	2·5	.....	.....	26 21	4·4	7 21	7·1	19 21	9·2
		18 21	1·7	.....	.....	.....	.....	10 21	7·8	20 21	11·1
		22 21	2·8	.....	.....	.....	.....	23 21	3·9	21 21	11·4
		30 21	2·5	.....	.....	.....	.....	24 21	5·6	28 21	5·2
								25 21	7·5	29 21	14·2
										31 21	5·2

Table (Continued).

Number of the Tables.	1842. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LXXIII.	Nov.	7 21	(9·3)	13 21	4·4	11 21	4·2	1 21	8·9	2 21	11·9
		8 21	4·5	23 21	4·5	21 21	8·7	3 21	9·1	16 21	8·0
		9 21	(9·0)	.....	.....	24 21	4·7	4 21	8·0	18 21	11·9
		10 21	3·1	.....	.....	28 21	5·5	5 21	7·3		
		14 21	4·5	.....	.....	29 21	6·7	6 21	9·3		
		15 21	1·0	.....	.....	.....	.....	12 21	4·9		
		17 21	(9·4)	.....	.....	.....	.....	22 21	5·0		
		19 21	2·0	.....	.....	.....	.....	25 21	7·0		
		20 21	8·7	.....	.....	.....	.....	26 21	8·4		
								27 21	6·6		
								30 21	8·2		
LXXIII.	Dec.	1 21	3·3	9 21	8·0	4 21	5·5	13 21	7·1	2 21	9·4
		3 21	1·8	.....	.....	16 21	4·8	15 21	8·2	5 21	4·8
		6 21	2·0	.....	.....	22 21	5·1	18 21	2·8	14 21	7·7
		7 21	2·3	.....	.....	.....	.....	23 21	4·6	17 21	5·7
		8 21	5·1	.....	.....	.....	.....	28 21	5·3	24 21	6·5
		10 21	3·0	.....	.....	.....	.....	31 21	9·4	27 21	5·2
		11 21	1·2								
		12 21	5·7								
		19 21	3·7								
		20 21	1·8								
		21 21	2·3								
		25 21	3·0								
		26 21	1·7								
		29 21	1·8								
		30 21	3·1								
LXXIV.	1843. Jan.	.....	.....	3 21	(8·2)	9 21	8·4	12 21	6·9	1 21	10·9
		11 21	4·8	6 21	3·9	13 21	5·5	15 21	9·1	2 21	11·7
		19 21	2·0	7 21	1·8	14 21	5·9	30 21	5·8	4 21	7·7
		22 21	(6·2)	17 21	3·8	24 21	6·3	.....	.....	5 21	9·5
		23 21	(9·9)	18 21	4·5	25 21	4·4	.....	.....	8 21	10·0
		26 21	3·6	20 21	5·4	28 21	5·7	.....	.....	10 21	6·7
		27 21	3·8	29 21	5·0	.....	.....	.....	.....	16 21	8·5
		31 21	2·8	.....	.....	.....	.....	.....	.....	21 21	11·1
LXXV.	Feb.	7 21	2·8	3 21	(0·3)	2 21	6·4	1 21	5·6	10 21	9·1
		8 21	3·0	4 21	3·5	6 21	7·7	5 21	8·9	12 21	14·1
		9 21	4·7	15 21	10·8	17 21	9·7	.....	.....	13 21	11·4
		11 21	3·1	.....	.....	21 21	12·9	.....	.....	16 21	13·0
		14 21	(13·3)	.....	.....	23 21	5·4	.....	.....	22 21	7·3
		18 21	3·0								
		19 21	0·6								
		20 21	3·9								
		24 21	0·8								
		25 21	(8·5)								
		26 21	3·9								
		27 21	3·0								
		28 21	7·8								

Table (Continued).

Number of the Tables.	1843. Month.	General state of the sky during the night previous to reading the instruments.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.	Day and hour of reading.	Excess of the reading of the thermometer in air above that placed in the focus of the reflector.
		d h	°	d h	°	d h	°	d h	°	d h	°
LXXVI.	March	10 21	11·4	30 21	10·5	21 21	7·1	12 21	7·5	1 21	12·0
		11 21	4·3	.....	.....	22 21	7·9	16 21	8·7	2 21	17·6
		13 21	3·8	.....	.....	26 21	6·8	20 21	8·0	3 21	12·1
		14 21	2·0	.....	.....	.....	.....	23 21	8·7	4 21	11·2
		15 21	2·5	.....	.....	.....	.....	24 21	8·9	5 21	10·5
		27 21	5·7	.....	.....	.....	.....	.....	.....	6 21	14·2
		31 21	7·1	.....	.....	.....	.....	.....	.....	7 21	11·5
										8 21	10·5
										9 21	12·7
										17 21	11·2
										18 21	10·0
										19 21	6·0
										25 21	9·2
										28 21	12·3
										29 21	12·6
LXXVII.	April	1 21	3·1	2 21	2·8	3 21	6·4	8 21	5·2	4 21	8·3
		6 21	1·8	.....	.....	5 21	3·1	10 21	6·8	9 21	9·4
		14 21	3·8	.....	.....	7 21	4·2	16 21	6·6	11 21	9·4
		15 21	2·4	.....	.....	12 21	6·9	19 21	9·5	13 21	9·2
						20 21	5·3	21 21	9·0	17 21	10·3
						25 21	4·5	29 21	7·3	18 21	9·0
						26 21	5·8	.....	.....	22 21	13·0
						28 21	6·6	.....	.....	23 21	12·0
										24 21	12·4
										27 21	9·4
										30 21	9·1

Table LXXVIII.

General state of the sky during the night previous to reading the instruments.	1843. April. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air at the height of 4 feet, and protected from the effects of radiation above that placed					
			On long grass exposed to $\frac{3}{4}$ths of sky.	On short grass.	On garden mould.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	22 21	37·0	.....	11·2	4·0	.....	.....	13·0
	23 21	36·0	.....	6·8	4·3	.....	.....	12·0
	30 21	48·6	8·1	7·6	8·6	8·6	7·9	9·1
Principally cloudless.	19 21	42·3	.....	9·3	0·3	.....	.....	9·3
	24 21	34·2	.....	12·7	4·4	.....	.....	12·4
Half-cloudy.	20 21	42·3	.....	3·3	0·3	.....	.....	3·3
	21 21	48·0	.....	9·0	5·2	.....	.....	9·0
	26 21	38·2	4·7	6·2	4·4	4·7	4·2	6·7
Principally cloudy.	27 21	37·4	11·7	9·7	1·1	8·4	5·1	9·4
Cloudy.	28 21	41·8	4·0	5·6	2·3	4·8	3·0	6·6
	29 21	46·0	7·3	8·1	6·2	6·0	7·3	7·3

Table LXXIX.

General state of the sky during the night previous to reading the instruments.	1843. May. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass exposed to $\frac{3}{4}$ths of sky.	On short grass.	On garden mould.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	1 21	46·3	5·0	8·4	3·0	9·1	5·2	10·5
	10 21	39·9	6·9	11·9	4·9	13·7	10·1	10·4
Principally clear.	2 21	40·7	2·9	7·0	1·7	6·8	4·1	7·7
	6 21	35·4	1·4	1·2	1·4	4·8	3·6	6·4
	7 21	37·3	4·0	1·4	3·7	9·9	8·0	9·3
	11 21	40·3	4·4	10·4	4·4	10·8	9·1	8·8
	14 21	54·5	7·0	7·8	5·9	7·5	7·8	6·9
	25 21	47·3	3·3	3·2	3·0	6·8	6·8	5·8
	28 21	45·2	8·7	4·0	3·0	6·5	7·7	9·0
Half-cloudy.	4 21	47·1	7·3	10·9	3·5	10·1	8·7	4·8
	21 21	44·4	1·9	1·4	2·4	5·4	6·6	5·1
	22 21	48·1	2·7	5·1	3·0	6·4	6·2	5·2
	24 21	48·5	4·5	9·0	8·0	7·3	8·8	5·3
Principally cloudy.	9 21	42·8	3·8	4·3	2·2	8·8	6·9	7·3
	19 21	47·5	7·0	4·3	7·3	.....	7·3	7·7
	26 21	47·3	3·3	4·3	2·3	4·3	3·3	5·8
	27 21	44·8	3·3	4·6	2·2	4·6	5·0	3·0
	29 21	38·5	3·5	3·0	3·3	9·5	9·0	9·2
	31 21	55·3	2·1	1·1	1·5	1·9	2·1	1·5
Cloudy.	3 21	37·3	−2·7	1·3	−4·2	1·3	0·2	−0·2
	5 21	50·2	2·4	0·9	1·4	2·7	2·7	2·0
	8 21	38·0	1·0	−1·0	0·0	1·5	1·2	−4·0
	12 21	51·3	7·5	5·5	6·0	3·3	7·6	2·1
	13 21	45·0	3·0	4·5	−0·5	4·5	3·5	3·8
	15 21	49·4	5·4	2·1	2·4	3·4	3·2	3·7
	16 21	49·3	9·3	6·3	7·3	.....	10·3	5·0
	17 21	44·0	2·0	0·0	1·8	4·0	4·0	4·5
	18 21	44·8	1·7	−0·9	0·7	1·5	2·9	3·8
	20 21	50·3	7·0	7·0	4·1	6·7	9·3	8·6
	23 21	52·6	4·6	6·1	5·8	8·9	9·0	2·8
	30 21	50·3	3·3	1·9	2·2	3·0	3·1	2·8

Table LXXX.

General state of the sky during the night previous to reading the instruments.	1843. June. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass exposed to $\frac{3}{4}$ths of sky.	On short grass.	On garden mould.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	3 21	47·1	4·3	8·1	3·8	8·6	8·9	8·5
	16 21	48·4	4·9	8·5	3·4	11·3	10·5	10·4
	21 21	53·0	9·0	11·0	8·0	8·0	12·0	13·0
	22 21	44·8	4·8	11·1	4·6	10·8	11·0	10·2
	23 21	50·4	7·2	6·6	5·9	12·9	12·7	12·4
	25 21	45·3	4·6	11·1	4·2	11·6	11·3	8·0
	28 21	43·5	10·2	11·7	7·5	10·5	12·5	9·3
Principally clear.	2 21	51·3	2·3	2·3	1·9	3·0	2·5	3·3
	4 21	42·9	1·5	4·1	1·7	5·4	5·4	5·6
	5 21	43·4	3·6	8·1	3·1	9·9	8·7	7·4
	15 21	51·6	4·4	5·1	3·0	9·6	10·4	11·2
	18 21	50·5	2·5	5·5	1·4	7·5	7·4	5·4
	20 21	44·1	4·1	8·5	3·6	10·8	9·8	10·9
	29 21	52·1	6·3	7·9	5·5	12·0	11·3	9·5
Half-cloudy.	26 21	47·0	3·8	7·3	4·0	10·8	10·6	8·0
Principally cloudy.	1 21	53·5	6·9	11·5	6·3	6·5	10·5	4·4
	6 21	45·2	2·6	3·6	2·2	6·2	5·5	6·0
	8 21	51·2	1·7	2·2	3·0	3·2	2·3	2·7
	9 21	49·1	2·8	3·5	2·9	3·6	3·1	4·3
	10 21	47·8	8·3	5·8	7·8	5·8	6·0	6·3
	11 21	48·8	4·2	5·3	3·6	5·0	6·5	6·7
	24 21	49·8	2·7	1·2	0·3	1·1	2·0	2·3
	27 21	50·2	3·4	1·9	4·2	6·0	6·9	7·2
	30 21	52·3	8·3	8·3	9·5	9·5	11·3	10·1
Cloudy.	7 21	49·9	2·1	1·1	1·2	3·9	1·8	1·4
	12 21	48·8	.....	.....	.....	0·8	.....	2·2
	13 21	51·8	1·3	−1·7	1·8	0·3	1·6	0·8
	14 21	57·0	4·5	5·9	3·6	6·8	7·1	6·4
	17 21	50·6	0·6	1·6	−1·9	3·0	2·1	2·0
	19 21	50·3	3·2	0·6	1·4	.....	3·2	3·3

Table LXXXI.

General state of the sky during the night previous to reading the instruments.	1843. July. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass exposed to $\frac{1}{2}$ths of sky.	On short grass.	On garden mould.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	4 21	57·1	10·6	13·6	10·6	11·3	10·1	8·9
	9 21	51·3	4·1	11·8	.....	12·8	9·8	11·3
Principally clear.	2 21	58·6	7·1	8·6	7·6	8·6	8·6	10·1
	7 21	53·4	6·6	5·4	.....	6·2	5·2	6·2
	8 21	47·3	7·3	7·3	.....	7·3	7·3	7·1
	16 21	58·4	4·3	4·3	.....	5·4	4·8	6·3
	17 21	58·1	4·1	4·1	.....	.....	4·4	6·1
	19 21	46·1	6·1	6·1	.....	6·1	6·1	7·1
	23 21	44·6	5·2	5·2	.....	7·4	7·6	9·4
	24 21	46·1	9·6	9·6	.....	9·9	9·9	10·1
	25 21	51·1	4·5	4·5	.....	8·6	8·3	7·5
	29 21	53·5	4·0	4·0	.....	4·0	4·0	5·9
Half-cloudy.	1 21	53·1	2·8	7·1	7·8	4·9	9·5	9·1
	3 21	59·1	2·3	3·1	1·1	3·3	2·6	4·6
	6 21	52·2	3·7	5·2	.....	5·9	5·5	6·8
	14 21	55·4	3·9	10·4	.....	5·4	8·6	5·4
	15 21	57·2	3·3	7·2	.....	6·4	5·0	6·2
	30 21	51·9	5·4	5·4	.....	7·0	6·6	7·9
	31 21	50·1	5·1	5·1	.....	8·1	7·3	6·1
Principally cloudy.	5 21	55·8	3·0	1·8	.....	.....	3·0	3·6
	10 21	54·8	1·2	0·8	.....	5·4	0·8	1·6
	21 21	55·1	4·7	4·7	.....	6·8	6·4	8·1
	22 21	51·7	1·7	1·7	.....	3·7	4·7	1·1
	26 21	57·3	4·8	4·8	.....	5·1	4·8	6·8
	27 21	56·6	4·6	4·6	.....	4·6	4·4	6·4
Cloudy.	11 21	52·8	5·8	1·2	.....	.....	1·8	3·8
	12 21	55·3	1·3	1·1	.....	1·1	0·9	1·8
	18 21	52·3	3·8	3·8	.....	9·6	5·1	7·3
	20 21	54·1	4·0	4·0	.....	4·0	4·1	5·1
	28 21	53·1	0·2	0·2	.....	−0·1	−0·2	1·1

Table LXXXII.

General state of the sky during the night previous to reading the instruments.	1843. August. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of the thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed				
			On long grass exposed to ¾ths of sky.	On short grass.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°
Cloudless.	6 21	48·7	4·7	6·9	7·2	7·4	7·3
	10 21	47·2	6·4	12·2	13·0	13·0	9·4
	11 21	51·0	6·2	9·0	9·1	9·5	9·0
	12 21	49·7	6·7	13·7	12·9	13·3	9·9
	17 21	59·6	6·0	11·0	11·6	11·0	9·0
	18 21	59·0	5·0	11·0	11·0	11·4	10·0
Principally cloudless.	1 21	49·4	2·8	4·5	4·6	4·6	6·5
	5 21	53·6	3·6	4·6	4·6	4·4	6·4
	7 21	60·0	7·0	8·8	9·0	8·0	11·8
	9 21	57·5	6·2	6·8	6·7	6·9	5·0
	13 21	58·6	5·8	8·8	8·4	8·9	10·4
	16 21	56·8	4·8	7·5	7·3	7·4	7·6
	20 21	50·2	4·0	6·6	6·2	6·8	8·2
	21 21	51·0	3·0	6·8	6·8	7·6	9·2
	22 21	49·5	2·8	4·5	4·5	4·7	6·0
	24 21	50·0	5·6	9·7	9·4	10·0	9·8
	26 21	49·2	4·9	8·0	8·1	8·8	7·5
	31 21	56·2	5·4	8·0	8·4	8·5	8·2
Half-cloudy.	3 21	56·0	3·2	9·0	4·0	8·0	5·8
	4 21	52·6	4·5	4·5	5·0	5·0	6·6
	14 21	61·8	6·4	4·0	6·8	4·0	5·8
	15 21	61·8	4·0	7·0	6·8	7·0	7·9
	19 21	62·0	3·9	7·3	7·0	7·5	8·1
	25 21	58·4	1·8	6·0	5·6	6·3	5·9
	27 21	62·0	4·0	3·7	3·7	3·7	5·0
Principally cloudy.	8 21	59·3	3·2	5·6	5·5	5·8	6·1
	30 21	59·5	7·0	8·4	8·2	8·8	8·0
Cloudy.	23 21	53·9	0·7	1·3	1·4	1·2	3·9
	29 21	61·0	2·3	1·2	1·7	2·2	3·8

Table LXXXIII.

General state of the sky during the night previous to reading the instruments.	1843. September. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass exposed to $\frac{3}{4}$ths of sky.	On long grass.	On short grass.	One inch high.	Three inches high.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	2 21	56·8	10·3	.....	8·5	8·5	8·5	7·3
	5 21	48·1	6·1	.....	5·1	7·1	9·1	7·5
	6 21	52·9	5·8	.....	8·9	8·9	8·9	10·5
	9 21	58·0	6·7	.....	11·8	12·3	12·0	11·0
	13 21	50·0	.....	13·8	12·0	8·5	7·0	13·0
	19 21	53·3	.....	12·3	13·3	9·3	5·8	10·8
	20 21	50·6	.....	8·8	7·8	6·6	3·6	6·1
	22 21	50·8	.....	10·8	11·5	8·8	5·2	10·3
	23 21	52·6	.....	11·4	9·5	9·1	5·5	7·8
	24 21	47·4	.....	9·9	10·6	8·1	4·5	8·1
	27 21	38·8	.....	13·0	10·9	9·8	6·3	8·4
Principally cloudless.	4 21	44·3	.....	.....	9·0	9·1	9·8	9·0
	7 21	56·6	7·4	.....	12·4	12·8	12·5	11·6
	12 21	51·8	.....	.....	10·8	10·8	10·9	9·5
	18 21	60·2	.....	8·8	8·0	5·7	3·2	6·7
	26 21	39·5	.....	8·7	8·5	7·3	3·3	7·5
	28 21	36·0	.....	.....	.....	.....	.....	8·4
Half-cloudy.	1 21	58·6	5·3	.....	8·3	8·3	8·8	8·9
	10 21	57·7	4·1	.....	5·7	5·3	6·1	8·6
	15 21	58·0	.....	10·8	9·3	6·0	4·0	7·0
	16 21	54·9	.....	7·2	6·1	3·9	2·8	3·7
	17 21	57·8	.....	8·8	7·3	5·8	3·6	3·8
	21 21	52·0	.....	9·8	10·3	8·8	3·8	9·0
	29 21	47·8	.....	10·4	9·7	7·3	4·8	9·7
Principally cloudy.	11 21	58·7	5·4	.....	5·8	5·2	6·5	10·0
	14 21	61·0	.....	.....	4·2	2·0	4·0	2·5
	28 21	43·4	.....	6·2	5·1	4·7	3·4	7·4
Cloudy.	3 21	57·2	5·7	.....	3·7	4·2	4·6	7·2
	8 21	61·6	4·8	.....	5·4	5·3	5·6	8·6
	30 21	55·8	.....	−0·5	−0·4	−0·2	−0·9	−0·4

Table LXXXIV.

General state of the sky during the night previous to reading the instruments.	1843. October. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed								
			On long grass.	On short grass.	One inch high.	Three inches high.	Six inches high.	In focus of metallic reflector.	On white cotton wool.	On white raw wool.	On coarse flax.	On fine flax.
	d h	°	°	°	°	°	°	°	°	°	°	°
Cloudless.	16 21	32·3	7·8	7·2	5·8	.....	5·2	8·6				
	18 21	28·5	10·0	9·0	8·5	.....	.....	11·0	12·3	14·0	13·0	17·3
	19 21	28·9	8·2	6·9	5·2	.....	.....	5·0	9·1	11·9	11·6	11·1
	21 21	37·5	7·3	5·6	4·5	.....	.....	5·3	7·0	10·0	8·0	9·5
	23 21	47·9	5·1	3·7	2·7	.....	.....	4·7	9·9	13·7	5·7	7·1
	25 21	29·3	7·5	6·3	5·7	.....	.....	6·1	9·3	10·3	10·3	10·8
	26 21	32·3	6·8	4·2	4·2	.....	.....	4·6	6·8	8·5	8·1	7·8
	29 21	40·1	11·2	8·1	6·3	.....	.....	7·6	11·3	13·6	13·4	13·4
Principally cloudless.	3 21	56·3	8·0	6·3	5·3	.....	3·5	4·1				
	5 21	51·3	5·7	5·9	3·3	.....	1·3	4·3				
	9 21	39·1	8·5	8·2	7·1	.....	3·1	5·9				
	12 21	34·9	6·7	5·4	3·7	.....	2·4	6·4				
	14 21	31·0	9·7	9·3	7·5	.....	3·8	10·3				
	15 21	29·7	9·9	9·2	9·3	.....	4·6	10·3				
	22 21	46·3	10·1	8·3	7·6	.....	.....	9·5	9·5	10·1	9·3	10·1
	28 21	34·5	5·7	4·2	3·2	.....	.....	5·7	7·7	7·5	8·5	8·5
Half-cloudy.	1 21	55·8	5·5	5·3	3·8	3·3	.....	5·3				
	2 21	50·0	8·2	8·1	5·9	.....	3·8	8·0				
	4 21	54·3	9·7	8·9	7·8	.....	4·4	7·3				
	6 21	56·9	6·2	5·7	5·9	.....	4·3	4·7				
	17 21	36·5	5·5	3·5	3·0	.....	.....	4·6	6·2	8·0	7·0	6·5
	24 21	46·5	2·9	2·0	2·3	.....	.....	2·3	1·7	2·7	2·6	2·7
Principally cloudy.	7 21	58·0	4·8	3·0	3·0	.....	3·0	2·8				
	13 21	36·6	8·1	6·4	4·9	.....	3·6	6·0				
	27 21	38·5	7·0	2·5	2·5	.....	.....	5·0	6·5	2·5	2·5	2·5
Cloudy.	8 21	48·5	.....	.....	.....	.....	.....	0·9				
	10 21	46·9	0·7	0·9	0·9	.....	1·7	0·7				
	11 21	42·3	7·3	5·0	3·8	.....	2·3	6·4				
	20 21	38·3	3·3	0·6	−0·5	.....	.....	3·8	2·8	6·3	5·9	5·8
	30 21	51·1	6·9	1·8	1·6	.....	.....	1·6				
	31 21	42·5	0·3	0·2	0·0	.....	.....	1·0				

Table LXXXV.

General state of the sky during the night previous to reading the instruments.	1843. Nov. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed							
			On long grass.	On short grass.	One inch high.	In focus of metallic reflector.	On white raw wool.	On white cotton wool.	On fine flax.	On coarse flax.
	d h	°	°	°	°	°	°	°	°	°
Cloudless.	8 21	29·8	10·7	8·4	6·3	10·1	14·8	13·8	13·0	12·8
	11 21	32·6	10·6	8·4	.....	9·6	15·3	11·6	13·8	15·4
	12 21	27·4	11·5	8·4	.....	8·2	13·9	11·2	12·9	14·2
	13 21	32·3	10·3	8·1	.....	9·1	16·1	10·8	9·9	10·3
	16 21	31·0	8·9	7·8	.....	6·2	.....	.....	9·2	8·9
	29 21	32·9	7·1	6·9	.....	7·6	11·4	.....	10·2	
Principally cloudless.	1 21	35·9	7·3	4·9	3·9	3·9	8·9	8·1	11·7	9·3
	4 21	43·0	7·8	5·2	4·8	6·0	11·0	7·4	9·2	10·8
	6 21	47·4	12·9	3·6	3·2	3·9	6·4	3·4	5·6	5·8
	7 21	41·5	8·5	8·3	5·5	6·3	11·5	9·5	10·5	10·0
	9 21	31·6	8·8	.....	.....	10·1	12·1	11·6	11·6	11·7
	18 21	34·6	5·8	5·4	.....	5·8	5·8	.....	6·2	
	28 21	44·4	10·9	9·6	.....	9·4	11·2	.....	9·2	
Half-cloudy.	3 21	47·8	5·8	4·8	3·8	5·3	9·3	6·8	8·6	8·6
	14 21	30·8	10·8	10·2	.....	9·8				
	19 21	37·9	0·6	.....	.....	4·9	2·9			
	20 21	41·8	4·7	5·5	.....	5·6	6·3	.....	6·1	
	24 21	35·5	5·3	4·8	.....	7·6	8·0	.....	8·0	
	25 21	45·9	5·5	5·3	.....	5·5	9·3	.....	9·3	
	26 21	51·6	3·0	3·2	.....	2·9	3·2	2·9		
Principally cloudy.	26 21	51·6	3·0	3·2	.....	2·9	3·2	.....	3·4	
	27 21	46·7	4·7	4·7	.....	0·1	5·9	.....	5·2	
Cloudy.	2 21	41·2	−1·3	−0·3	0·3	−0·1	0·6	−0·1	0·2	−0·1
	5 21	40·7	6·3	4·0	3·5	3·7	7·7	4·7	6·5	8·5
	15 21	31·6	1·6	0·3	.....	1·8	3·4	1·3	−0·4	0·2
	17 21	37·7	2·5	2·7	.....	2·7	3·5	2·5	3·7	3·1
	21 21	52·6	4·1	4·3	.....	3·6	4·6			
	22 21	44·6	2·4	2·1	.....	2·8	3·5			
	25 21	45·9	−0·3	−4·1	.....	0·1	−0·1	.....	−0·1	
	30 21	45·7	1·6	...	.....	1·2				
Cloudy: cirro-cumulus	10 21	32·6	9·7	7·6	.....	9·5	12·6	12·2	12·3	13·4

Table LXXXVI.

General state of the sky during the night previous to reading the instruments.	1843. Dec. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed						
			On long grass.	On short grass.	On coarse flax.	On white raw wool.	On blackened tin.	On white tin.	In focus of metallic reflector.
Cloudless.	d h None.	°	°	°	°	°	°	°	° .....
Principally cloudless.	2 21	36·5	5·7	4·3	6·5	6·7	4·2	1·7	6·4
	6 21	40·2	5·9	6·2	7·2	7·2	5·4	4·2	7·2
	8 21	33·7	4·9	.....	4·2	7·2	5·5	4·7	5·5
	10 21	39·0	10·2	9·0	10·2	10·0	9·2	8·0	7·2
	17 21	38·5	8·7	9·5	6·7	7·0	5·3	5·7	4·1
Half-cloudy.	5 21	40·1	7·1	6·1	7·3	6·9	5·9	5·9	7·9
Principally cloudy.	1 21	37·6	8·6	8·6	8·3	7·4	8·6	6·8	10·4
	7 21	45·7	6·2	4·7	5·7	6·9	4·2	3·4	3·8
	14 21	39·3	2·5	4·3	3·3	3·5	3·7	2·3	4·3
	15 21	43·1	6·3	4·9	6·3	5·1	4·9	.....	5·1
	24 21	48·4	7·7	6·2	6·0	6·2	4·4	3·2	5·4
	25 21	42·7	8·9	8·3	10·6	10·7	7·8	6·0	7·5
	27 21	42·5	2·9	2·9	2·7	2·5	2·5	2·5	3·5
Cloudy.	3 21	45·3	2·3	3·3	2·0	2·1	.....	.....	3·3
	4 21	45·5	1·9	2·2	1·5	1·7	2·1	2·2	2·8
	9 21	35·1	2·5	−1·9	1·1	0·6	0·8	1·1	2·6
	11 21	30·4	1·1	1·4	2·2	0·3	0·4	0·2	2·9
	12 21	25·6	3·8	3·4	5·3	2·8	4·6	4·3	2·8
	13 21	39·3	6·6	7·8	7·1	8·3	6·5	5·3	2·3
	16 21	44·7	7·5	5·9	5·9	5·6	.....	3·2	5·7
	18 21	42·5	2·5	3·2	3·1	2·4	2·5	2·7	3·7
	19 21	42·3	0·6	0·0	2·0	1·1	1·3	2·3	3·6
	20 21	41·4	3·9	2·4	2·2	1·9	1·9	1·9	3·2
	21 21	41·9	2·9	2·7	2·3	2·2	1·8	2·1	3·9
	22 21	42·5	0·5	1·2	0·9	−0·3	0·3	0·9	2·3
	23 21	49·8	5·6	4·8	5·0	4·2	4·0	3·8	4·5
	26 21	42·5	1·5	2·5	1·5	0·9	1·5	1·9	2·7
	28 21	42·5	1·8	2·0	1·6	1·9	1·2	1·4	2·3
	29 21	38·5	3·2	3·2	3·5	3·3	2·5	2·6	5·2
	30 21	39·3	2·1	2·5	2·8	2·1	2·1	2·5	3·7

Table LXXXVII.

General state of the sky during the night previous to reading the instruments.	1844. January. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed						
			On long grass.	On short grass.	On flax.	On white raw wool.	On blackened tin.	On white tin.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°	°
Cloudless.	2 21	18·6	8·8	.....	.....	.....	.....	.....	8·3
	15 21	25·4	10·2	9·9	10·6	13·4	9·6	8·9	7·7
Principally cloudless.	7 21	32·2	8·0	7·0	7·2	7·7	7·0	6·2	3·2
	20 21	33·2	9·0	7·2	9·0	12·2	8·0	6·2	6·2
	21 21	39·2	7·4	7·2	9·2	11·2	7·4	6·2	3·6
	22 21	31·4	10·2	8·7	9·5	3·7	9·4	10·1	5·4
	24 21	30·5	8·5	7·5	9·0	11·5	8·5	8·0	6·0
	26 21	35·2	7·0	6·0	7·2	9·3	7·0	6·2	2·2
	28 21	37·3	9·5	8·5	9·4	10·1	8·4	8·1	5·6
Half-cloudy.	6 21	37·8	6·4	5·8	4·8	7·4	6·5	5·1	1·6
	14 21	28·3	7·9	5·7	6·0	10·3	7·3	5·3	7·3
	16 21	27·6	7·0	5·4	6·4	11·9	6·6	5·4	4·6
	18 21	39·2	7·0	6·1	4·2	6·9	7·0	5·4	2·7
	19 21	37·4	8·6	6·6	5·8	9·2	6·7	5·7	3·9
Principally cloudy.	5 21	45·8	5·6	4·5	3·6	3·5	4·8	2·8	1·8
	10 21	36·4	7·7	6·4	5·4	7·4	8·4	8·1	1·9
	11 21	37·7	8·5	8·7	7·9	11·7	9·5	9·3	3·3
	25 21	35·3	4·7	3·5	2·7	3·0	3·5	3·5	1·6
	27 21	40·6	7·3	5·6	6·5	6·2	5·8	5·1	2·1
	29 21	39·7	8·3	8·0	7·1	8·5	7·5	7·4	3·9
	31 21	27·7	5·9	6·4	5·7	8·9	7·2	7·7	3·9
Cloudy.	3 21	22·4	2·9	.....	3·4	3·4	.....	.....	3·4
	8 21	34·2	7·6	6·4	5·6	7·5	7·2	7·2	1·8
	9 21	30·7	1·7	0·9	0·2	1·7	0·9	0·5	0·2
	12 21	39·2	1·8	1·7	1·2	2·4	2·4	1·9	−0·8
	13 21	32·7	1·6	0·9	0·7	1·5	1·7	1·2	−1·8
	17 21	36·5	4·5	4·2	3·3	3·9	4·5	1·7	0·5
	23 21	36·2	4·6	4·2	4·6	5·9	4·9	3·9	2·4
	30 21	32·3	3·3	2·3	1·2	2·7	2·9	2·3	−0·3

Table LXXXVIII.

General state of the sky during the night previous to reading the instruments.	1844. February. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed						
			On long grass.	On short grass.	On flax.	On white raw wool.	On blackened tin.	On white tin.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°	°
Cloudless.	1 21	27·2	8·6	5·7	6·6	9·0	7·6	8·0	6·4
	15 21	33·0	11·6	8·8	12·0	9·8	9·2	10·9	7·8
	16 21	34·0	7·7	6·5	6·9	6·7	6·0	5·0	6·2
	22 21	22·2	10·4	7·5	10·8	9·8	7·7	7·0	7·7
Principally cloudless.	4 21	29·0	7·5	6·0	6·0	10·2	10·0	10·0	6·0
	6 21	25·4	8·2	6·6	11·6	6·8	8·4	6·6	7·1
	7 21	32·2	5·5	5·0	9·7	6·0	5·2	4·7	3·4
	8 21	32·7	7·1	5·5	5·3	8·7	6·4	6·5	3·6
	19 21	29·7	8·4	6·2	7·8	6·7	5·8	7·0	6·7
	20 21	27·3	8·5	5·3	6·7	9·0	6·3	6·1	6·3
Half-cloudy.	17 21	36·7	7·5	5·3	5·2	3·7	4·7	4·7	4·5
	18 21	40·6	5·4	6·2	4·0	2·8	5·1	1·5	3·8
	24 21	33·4	8·2	5·8	7·2	8·6	6·9	6·4	6·4
	25 21	39·5	6·6	5·2	4·9	3·7	5·5	5·9	3·0
	27 21	29·2	3·8	1·0	4·4	2·7	3·1	2·9	1·2
	28 21	32·2	5·9	3·9	4·2	3·7	5·1	5·6	3·2
Principally cloudy.	6 21	32·0	7·2	5·7	9·0	8·0	6·2	5·7	3·2
	9 21	32·2	2·8	2·8	4·5	3·6	4·4	4·0	1·4
	10 21	31·7	6·5	4·5	4·7	4·7	5·2	4·7	3·9
	12 21	24·5	6·2	3·5	9·6	7·0	4·5	3·7	4·3
	13 21	20·0	6·0	2·0	11·0	12·2	4·0	5·2	3·4
	26 21	27·0	4·9	1·8	5·7	5·4	4·8	4·5	2·6
Cloudy.	2 21	28·0	3·0	2·0	4·0	3·0	6·5	7·0	3·0
	3 21	28·0	2·7	4·3	4·0	3·0	10·0	6·0	2·2
	11 21	30·2	6·0	6·0	4·1	7·2	5·2	4·7	4·7
	14 21	36·8	8·5	7·6	13·8	14·8	7·3	6·8	7·5
	21 21	32·0	0·2	0·3	0·5	−0·2	1·4	0·4	−1·5
	23 21	31·2	4·2	3·2	4·8	3·7	4·4	4·0	5·2
	29 21	38·8	3·0	1·6	4·3	1·5	3·4	3·1	1·8

Table LXXXIX.

General state of the sky during the night previous to reading the instruments.	1844. March. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass.	On short grass.	On flax.	On white raw wool.	On lead.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	5 21	24·1	8·9	7·9	14·5	14·9	8·5	12·1
	6 21	30·6	6·8	4·1	4·8	4·6	5·9	5·1
	12 21	31·1	7·1	4·1	5·6	6·8	5·0	4·1
	20 21	27·9	11·4	8·4	18·1	18·9	6·4	8·9
	21 21	32·0	7·2	6·3	12·8	12·4	4·7	5·3
	23 21	33·3	8·3	5·8	9·3	8·3	5·1	4·1
	28 21	34·9	8·7	7·1	13·4	12·6	5·7	5·9
Principally cloudless.	25 21	44·0	6·8	5·6	6·0	7·0	5·8	4·4
	30 21	39·8	6·3	5·5	9·0	8·7	4·5	5·4
Half-cloudy.	1 21	37·1	5·4	4·6	4·0	2·1	5·8	3·1
	3 21	38·6	5·6	3·4	4·6	4·9	4·2	2·1
	7 21	29·6	10·8	6·8	12·0	14·2	8·6	9·4
	10 21	31·7	5·4	3·7	7·7	7·4	4·2	2·7
	11 21	32·8	2·8	2·8	.....	.....	.....	0·0
	13 21	33·7	7·5	5·9	7·6	8·7	5·9	5·5
	17 21	30·3	5·7	4·0	5·5	6·1	4·8	5·1
	24 21	39·5	7·6	5·8	5·8	3·5	6·5	2·0
	29 21	37·9	7·9	5·1	7·9	6·6	2·7	9·3
Principally cloudy.	9 21	40·3	4·3	3·8	7·3	7·3	4·3	1·8
	15 21	36·0	6·6	5·8	6·8	7·9	6·5	5·6
	18 21	36·1	8·1	5·5	8·1	9·1	5·4	5·4
	19 21	39·5	7·3	6·0	6·5	7·2	6·5	4·5
	27 21	42·5	6·5	4·6	8·0	8·5	3·7	3·6
Cloudy.	2 21	35·3	4·3	4·3	4·3	4·3	5·3	2·3
	4 21	32·4	5·9	4·2	5·2	5·6	5·3	5·9
	8 21	36·2	4·6	3·0	3·1	3·8	3·0	3·5
	14 21	38·1	0·5	1·1	2·8	0·9	1·7	−0·2
	16 21	37·5	0·1	0·5	1·1	0·5	0·7	−1·0
	22 21	39·8	1·3	1·1	2·5	1·5	1·1	−1·2
	26 21	46·1	8·1	7·7	9·1	9·1	6·3	4·1
	31 21	37·3	0·6	0·2	2·0	2·4	−0·2	0·7

Table XC.

General state of the sky during the night previous to reading the instruments.	1844. April. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass.	On short grass.	On flax.	On white raw wool.	On lead.	In focus of metallic reflector.
	d h	°	°	°	°	°	°	°
Cloudless.	1 21	36·4	7·9	8·4	13·2	11·2	6·7	6·8
	2 21	41·6	12·9	13·4	19·4	17·6	12·9	9·4
	3 21	43·4	13·4	11·4	19·9	18·9	16·4	8·4
	4 21	44·4	11·4	11·1	14·4	14·4	6·9	5·4
	5 21	40·4	11·4	9·2	14·6	13·4	4·6	7·3
	6 21	34·4	10·9	8·9	13·6	12·4	6·4	5·1
	7 21	33·4	11·3	11·8	15·4	16·9	7·9	10·7
	8 21	39·4	10·2	9·9	16·2	15·8	8·4	6·1
	9 21	41·2	11·7	10·7	13·4	13·2	8·7	6·5
	10 21	38·3	13·1	11·6	18·0	16·8	9·5	8·7
	16 21	41·9	10·7	9·7	15·3	15·0	7·8	5·5
	17 21	44·6	11·1	10·6	16·6	15·3	8·6	5·3
	18 21	37·0	12·6	10·1	15·3	14·4	10·0	9·7
	24 21	39·4	14·9	13·6	19·9	20·4	12·4	12·4
	25 21	41·4	13·4	12·6	19·2	17·8	10·4	10·2
	28 21	35·7	11·7	11·4	18·1	15·4	9·5	10·7
	29 21	39·4	10·4	8·7	14·2	12·6	9·0	9·4
	30 21	40·7	12·5	10·5	14·4	14·2	10·2	6·3
Principally cloudless.	19 21	48·2	11·0	10·1	15·1	12·6	12·2	7·0
	22 21	45·1	12·1	10·9	19·1	16·5	13·6	8·3
	23 21	41·4	8·4	6·4	10·4	11·5	6·2	6·2
	27 21	37·1	9·8	9·2	13·4	12·0	8·5	8·1
Half-cloudy.	14 21	43·9	5·7	5·4	8·7	8·6	4·8	3·1
	15 21	48·6	6·6	6·1	8·4	8·5	4·0	4·2
	21 21	43·6	6·4	6·6	9·4	7·6	5·6	2·8
Principally cloudy.	11 21	42·0	10·0	8·8	14·0	14·0	6·8	7·8
	20 21	51·1	8·9	9·0	12·3	10·5	11·1	6·8
Cloudy.	12 21	46·4	2·4	2·5	5·1	6·0	2·1	2·1
	13 21	48·7	4·9	5·1	8·4	7·7	5·3	3·1
	26 21	46·1	0·6	0·1	1·3	2·0	0·4	1·1

Table XCI.

General state of the sky during the night previous to reading the instruments.	1844. May. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed					
			On long grass.	On short grass.	On flax.	On white raw wool.	On lead.	In focus of metallic reflector.
	h h	°	°	°	°	°	°	°
Cloudless.	1 21	40·9	12·3	12·3	16·1	12·8	10·9	7·3
	2 21	40·9	14·7	10·9	17·6	14·6	10·2	9·3
	3 21	48·0	11·8	9·7	12·0	13·0	7·8	7·8
	6 21	44·6	11·6	10·6	14·1	13·1	.....	9·1
	8 21	49·6	9·8	12·4	13·6	12·4	.....	8·6
	10 21	45·2	13·5	12·2	13·4	12·9	.....	7·7
	15 21	44·6	15·6	13·6	16·4	9·4	9·3	12·8
	23 21	44·2	7·5	6·1	10·8	10·3	.....	4·5
	25 21	40·6	9·4	9·1	11·1	11·4	.....	7·1
	27 21	42·1	6·8	9·4	6·9	9·1	.....	6·3
Principally cloudless.	5 21	44·6	9·6	11·6	11·9	11·4	9·3	4·2
	13 21	46·8	12·8	11·8	14·0	16·8	.....	7·8
	17 21	33·9	7·4	6·1	5·7	13·9	.....	6·9
	19 21	43·2	13·2	12·2	.....	.....	.....	6·4
	20 21	43·8	6·0	5·8	5·9	3·3	1·0	4·9
Half-cloudy.	7 21	46·7	11·7	10·7	.....	.....	.....	8·2
	12 21	44·4	8·4	7·4	.....	.....	.....	5·6
	16 21	44·4	12·4	10·4	14·5	14·5	7·4	8·4
	18 21	39·7	7·1	7·7	11·5	11·7	5·7	7·5
	21 21	37·4	2·4	1·3	2·3	2·4	0·5	−2·0
	26 21	42·0	8·7	8·5	.....	.....	.....	7·8
Principally cloudy.	24 21	46·2	5·2	4·7	8·7	8·7	.....	−1·3
Cloudy.	4 21	48·4	2·4	1·4	.....	.....	.....	−1·6
	9 21	51·7	10·7	9·9	9·4	9·3	.....	11·4
	11 21	51·4	3·4	2·4	.....	.....	.....	2·2
	14 21	42·4	9·4	8·4	.....	.....	.....	5·4
	22 21	47·4	0·2	0·0	.....	.....	.....	0·4
	28 21	46·8	3·3	4·3	4·1	4·8	.....	3·5
	29 21	45·2	5·2	5·7	.....	.....	.....	2·4
	30 21	45·9	3·4	3·8	4·6	4·9	.....	3·4
	31 21	44·5	11·9	12·5	15·5	15·7	.....	9·8

Table XCII.

General state of the sky during the night previous to reading the instruments.	1844. June. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed				
			On long grass.	On short grass.	On flax.	On white raw wool.	In focus of metallic reflector.
	d h	°	°	°	°	°	°
Cloudless.	10 21	48·1	10·8	10·1	9·5	9·6	5·1
	13 21	53·0	8·6	8·8	7·0	9·0	7·0
	16 21	47·1	10·9	9·4	5·7	5·6	2·5
	22 21	54·0	11·2	10·1	.....	.....	10·0
	23 21	63·1	12·2	7·1	9·1	9·1	6·6
	30 21	52·5	11·4	10·4	.....	.....	9·2
Principally cloudless.	1 21	44·1	8·1	8·1	10·1	9·3	7·9
	4 21	48·6	9·6	11·6	12·9	13·6	9·1
	8 21	52·8	10·5	11·2	12·3	.....	8·3
	14 21	49·2	7·9	7·0	7·2	7·9	6·0
	21 21	57·3	8·1	7·2	9·5	10·4	7·4
Half-cloudy.	3 21	48·8	10·8	10·8	.....	.....	7·9
	7 21	52·4	8·4	7·6	8·9	.....	4·6
	9 21	51·3	6·5	6·1	6·5	.....	4·8
	11 21	49·5	6·0	5·5	.....	.....	3·5
	17 21	53·9	10·7	11·5	6·9	8·8	4·1
	20 21	52·9	3·7	4·6	4·2	6·9	3·4
	29 21	58·9	7·9	7·1	.....	.....	6·9
Principally cloudy.	2 21	44·5	12·5	12·0	.....	.....	9·3
	5 21	54·2	6·6	6·2	8·4	6·4	5·0
	6 21	54·6	4·6	5·4	5·7	6·6	3·0
	12 21	52·7	7·4	6·3	7·2	8·9	0·2
	15 21	46·9	12·3	11·5	.....	.....	9·5
	18 21	52·5	9·7	8·2	10·3	11·2	7·3
	19 21	47·9	5·9	5·9	7·9	7·9	5·1
	24 21	58·9	6·8	6·0	7·9	7·9	1·9
	27 21	51·7	12·7	8·9	12·5	12·7	10·6
	28 21	49·9	8·1	8·2	12·1	11·6	8·1
Cloudy.	25 21	47·7	1·4	1·6	2·4	1·7	3·5
	26 21	52·9	1·9	1·6	2·6	1·9	3·9

Table XCIII.

General state of the sky during the night previous to reading the instruments.	1844. July. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed				
			On long grass.	On short grass.	On flax.	On white raw wool.	In focus of metallic reflector.
	d h	°	°	°	°	°	°
Cloudless.	13 21	59·0	8·0	6·0	.....	.....	6·5
	14 21	51·2	8·2	6·2	.....	.....	6·7
	15 21	54·5	14·2	12·8	16·8	11·5	12·9
	16 21	47·1	7·8	6·8	9·1	9·6	4·9
	18 21	47·3	11·8	10·3	16·1	13·3	7·3
	19 21	48·0	9·7	10·1	13·8	14·2	7·4
	20 21	49·5	10·0	8·5	12·0	12·0	7·5
	22 21	57·3	12·1	10·3	14·1	14·1	11·3
	23 21	60·2	10·2	8·6	11·4	11·9	7·7
	24 21	57·0	14·7	10·2	12·9	13·1	8·5
	27 21	53·3	10·3	8·2	11·3	11·3	7·3
	29 21	49·3	13·3	11·3	.....	.....	10·0
Principally cloudless.	21 21	53·8	8·8	10·0	13·1	12·9	7·1
Half-cloudy.	5 21	51·1	8·6	6·1	9·9	10·0	7·0
	7 21	55·0	8·0	7·2	.....	.....	3·7
	8 21	57·1	5·3	5·2	3·5	6·3	4·8
	9 21	51·7	9·2	8·7	11·5	7·9	7·9
	26 21	57·9	17·3	.....	.....	.....	7·9
Principally cloudy.	1 21	55·0	8·0	7·0	8·0	8·0	3·4
	3 21	54·6	7·6	7·0	8·1	8·1	5·0
	4 21	55·5	6·5	6·0	.....	.....	3·5
	11 21	56·2	5·2	4·9	5·2	5·2	4·4
	12 21	54·2	7·2	6·2	7·2	7·2	3·2
	17 21	54·5	4·5	3·5	5·3	4·5	6·5
	25 21	62·0	15·3	15·4	12·5	19·0	5·5
	28 21	58·1	8·1	7·1	.....	.....	3·8
	31 21	48·7	5·2	7·7	7·7	7·7	7·7
Cloudy.	2 21	52·5	3·9	2·4	3·5	2·9	2·9
	6 21	55·0	2·8	2·0	3·8	3·8	3·2
	10 21	60·5	3·5	2·0	.....	.....	1·5
	30 21	56·8	2·7	2·3	3·5	3·3	5·0

Table XCIV.

General state of the sky during the night previous to reading the instruments.	1844. August. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed				
			On long grass.	On short grass.	On flax.	On white raw wool.	In focus of metallic reflector.
	d h	°	°	°	°	°	°
Cloudless.	1 21	45·6	7·9	5·5	7·1	6·8	6·6
	2 21	52·8	11·3	9·8	11·3	12·6	8·2
	7 21	50·9	4·3	5·6	6·7	6·5	7·3
	8 21	49·2	6·2	6·7	8·6	8·7	7·4
	13 21	52·8	11·6	5·3	6·6	6·3	4·1
	14 21	49·0	8·0	5·5	8·5	8·0	4·9
	18 21	45·4	8·6	6·9	8·4	11·1	6·7
	27 21	42·8	11·0	10·0	12·0	.....	8·0
	28 21	44·6	9·3	8·8	12·5	.....	7·8
	29 21	46·8	10·0	10·1	13·9	.....	9·5
	30 21	46·2	10·5	9·3	11·9	.....	7·5
	31 21	46·3	8·5	7·8	10·6	.....	6·7
Principally cloudless.	4 21	49·7	9·5	5·3	7·7	8·4	9·4
	6 21	52·3	6·3	5·3	5·8	6·3	6·5
	15 21	50·3	7·7	4·8	7·4	6·8	7·8
	17 21	47·3	7·1	6·1	9·6	7·1	6·9
	22 21	48·2	8·3	6·4	9·4	8·5	6·7
	23 21	47·5	9·7	8·3	10·5	11·7	7·8
Half-cloudy.	3 21	54·2	4·6	4·5	16·6	14·0	7·2
	9 21	47·8	7·2	6·3	7·8	7·8	8·6
	10 21	45·3	11·1	8·1	12·3	11·3	8·8
	16 21	57·2	.....	.....	.....	.....	5·4
	26 21	51·2	10·0	6·7	10·9	.....	7·7
Principally cloudy.	20 21	51·6	6·4	5·3	5·9	5·8	7·9
Cloudy.	5 21	57·8	10·8	11·6	11·6	13·6	3·3
	11 21	56·2	4·2	4·2	.....	.....	3·7
	12 21	54·5	3·2	3·0	4·8	5·8	5·4
	19 21	57·7	0·9	0·7	0·9	1·0	1·1
	21 21	52·8	3·0	2·6	6·0	3·5	3·8
	24 21	52·3	7·6	5·8	7·3	8·5	6·5
	25 21	52·4	4·4	3·2	5·3	.....	9·1

Table XCV.

General state of the sky during the night previous to reading the instruments.	1844. September. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed			
			On long grass.	On short grass.	On flax.	In focus of metallic reflector.
	d h	°	°	°	°	°
Cloudless.	1 21	48·7	11·9	11·2	14·4	12·2
	4 21	59·4	6·3	5·9	8·1	7·9
	10 21	44·8	10·8	10·0	12·8	11·3
	18 21	41·3	11·3	8·3	11·3	7·8
	19 21	47·3	11·5	9·6	13·6	13·7
	20 21	45·9	11·1	10·9	14·6	10·1
	24 21	41·8	11·5	9·6	11·8	9·6
	25 21	40·8	10·5	8·4	12·6	9·6
	26 21	41·1	11·1	8·5	14·9	9·5
	27 21	40·3	9·9	6·1	.....	8·1
	28 21	45·1	9·8	8·1	.....	8·5
	29 21	34·8	9·8	7·3	12·2	7·6
Principally cloudless.	2 21	51·0	10·5	9·5	13·7	8·4
	5 21	57·0	10·0	9·7	12·4	8·3
	11 21	49·8	9·6	8·3	10·6	10·0
	21 21	47·1	10·6	10·1	13·1	11·1
	22 21	49·1	13·1	12·1	.....	5·1
Half-cloudy.	6 21	62·6	.....	.....	.....	16·2
	7 21	56·8	6·3	5·6	8·7	7·8
Principally cloudy.	12 21	52·9	7·5	5·7	8·6	8·2
	13 21	53·8	6·8	6·4	7·5	8·1
	16 21	60·8	5·4	4·6	6·5	5·0
	17 21	53·9	5·3	5·2	7·8	2·3
	23 21	49·3	7·0	3·9	7·4	8·1
Cloudy.	3 21	59·6	3·8	3·1	4·2	3·4
	8 21	55·5	3·2	1·5	3·2	6·0
	9 21	55·8	0·8	1·1	0·8	5·8
	14 21	57·3	4·8	4·4	4·9	6·0
	15 21	61·4	4·1	4·6	4·8	5·9
	30 21	42·2	1·6	2·6	2·9	

Table XCVI.

General state of the sky during the night previous to reading the instruments.	1844. October. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed			
			On long grass.	On short grass.	On flax.	In focus of metallic reflector.
	d h	°	°	°	°	°
Cloudless.	3 21	53·3	18·8	17·8	21·8	13·7
	7 21	33·2	10·2	8·7	19·5	4·2
	10 21	47·2	7·7	7·2	8·6	3·2
	18 21	36·5	6·7	5·3	7·5	4·2
	22 21	30·8	6·5	4·6	7·3	5·3
	26 21	43·2	12·5	9·0	13·7	7·4
	27 21	36·2	12·0	9·7	9·9	5·5
	30 21	40·8	11·0	7·6	10·6	5·6
Principally cloudless.	4 21	53·8	13·0	12·0	14·8	8·5
	5 21	44·0	10·2	9·0	13·0	3·5
	11 21	46·8	7·8	7·3	9·5	4·6
	14 21	47·5	6·4	5·5	8·0	7·0
	28 21	39·8	11·4	9·4	10·1	10·2
	31 21	44·2	8·2	5·5	7·0	6·7
Half-cloudy.	2 21	51·0	9·0	8·4	12·0	6·0
	6 21	44·1	8·7	8·1	8·1	4·0
	8 21	45·7	8·5	7·7	8·2	5·7
	13 21	49·2	7·9	6·2	12·2	7·2
	16 21	42·2	6·2	5·5	7·7	4·7
	17 21	39·8	5·4	4·5	7·8	8·3
Principally cloudy.	19 21	45·3	5·6	5·8	8·8	6·3
Cloudy.	1 21	57·6	5·1	4·6	5·6	3·2
	9 21	53·6	4·8	4·1	6·6	3·3
	12 21	55·8	5·7	6·0	9·8	3·6
	15 21	46·7	2·0	1·7	2·2	2·9
	20 21	44·5	10·0	6·4	11·5	7·9
	21 21	43·2	3·2	1·3	1·2	3·2
	23 21	35·5	7·7	9·7	13·3	5·0
	24 21	47·2	1·1	0·5	1·9	2·7
	25 21	43·1	9·1	5·5	16·1	7·9
	29 21	42·7	3·7	2·4	2·7	7·7

Table XCVII.

General state of the sky during the night previous to reading the instruments.	1844. November. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed			
			On long grass.	On short grass.	On flax.	In focus of metallic reflector.
	d h	°	°	°	°	°
Cloudless.	15 21	46·3	9·9	5·0	7·6	6·1
	20 21	34·8	10·3	5·8	11·8	5·8
Principally cloudless.	4 21	34·6	9·0	7·6	6·6	9·6
	13 21	43·4	10·8	8·9	9·4	6·4
	21 21	34·3	10·8	7·3	10·9	8·8
	23 21	33·5	11·0	8·8	11·5	9·5
	26 21	27·4	8·1	5·6	9·4	7·2
	27 21	29·5	7·5	4·8	9·5	5·0
	30 21	31·9	10·2	8·4	13·4	10·5
Half-cloudy.	6 21	38·3	9·3	7·6	8·3	7·3
	8 21	47·3	8·3	7·4	8·3	7·6
	9 21	38·3	4·9	4·6	7·0	6·3
	10 21	41·0	7·5	6·4	7·5	7·7
	24 21	36·6	9·4	6·0	10·7	8·6
	25 21	32·1	8·7	6·4	11·4	7·8
Principally cloudy.	3 21	36·8	7·0	4·0	6·1	8·0
	11 21	40·3	6·0	3·0	6·8	4·8
	16 21	49·0	5·0	4·4	6·4	4·2
Cloudy.	1 21	41·0	0·4	0·2	0·3	2·0
	2 21	37·0	1·0	0·1	0·5	2·5
	5 21	39·1	5·1	2·6	4·1	2·2
	7 21	43·9	3·4	2·6	3·1	4·6
	12 21	48·8	0·8	0·9	−0·1	1·8
	14 21	47·6	5·2	5·2	1·8	2·8
	17 21	48·7	0·8	0·6	0·6	2·7
	18 21	49·5	2·0	1·3	1·4	2·5
	19 21	46·4	2·9	1·9	1·1	4·5
	22 21	36·4	10·0	8·7	11·1	2·2
	28 21	35·5	3·8	3·0	3·5	4·6
	29 21	37·6	3·5	3·4	2·6	

Table XCVIII.

General state of the sky during the night previous to reading the instruments.	1844. December. Day and hour of reading.	Reading of thermometer in air at the height of 4 feet.	Excess of the reading of a thermometer in air, at the height of 4 feet and protected from the effects of radiation, above that placed			
			On long grass.	On short grass.	On flax.	In focus of metallic reflector.
	d h	°	°	°	°	°
Cloudless.	4 21	26·1	12·4	8·5	14·9	7·3
	5 21	21·4	13·5	7·4	17·4	13·7
	6 21	21·1	12·2	8·7	14·1	10·6
	7 21	24·5	9·6	5·9	10·0	10·1
	11 21	22·9	10·0	6·5	10·4	6·5
	19 21	31·3	8·0	6·0	6·8	7·8
Principally cloudless.	20 21	30·1	7·2	5·7	7·1	8·2
Half-cloudy.	None.	.....	.....	.....	.....	.....
Cloudy.	1 21	34·1	1·9	0·8	2·1	3·9
	2 21	32·3	3·0	0·4	2·3	5·1
	3 21	34·1	2·2	1·1	1·6	3·6
	8 21	25·1	2·3	0·8	−0·4	3·9
	9 21	27·8	1·7	0·3	8·5	3·3
	10 21	27·7	1·2	−0·2	2·7	3·0
	12 21	23·2	0·7	−0·8	0·4	2·9
	13 21	24·4	−0·3	−0·9	2·9	2·2
	14 21	28·1	2·8	1·4	2·3	2·7
	15 21	35·4	5·1	3·6	4·6	4·8
	16 21	37·1	1·1	0·4	0·3	2·9
	17 21	38·1	2·0	1·1	1·1	3·1
	18 21	40·3	0·8	0·3	0·3	2·3
	22 21	29·1	4·9	2·9	4·1	5·9
	23 21	29·5	2·4	0·7	1·5	4·0
	24 21	31·3	2·3	1·8	2·3	2·3
	25 21	31·1	1·8	0·8	1·3	3·4
	26 21	27·6	8·8	3·4	8·3	0·4
	27 21	29·8	3·6	0·9	3·8	2·6
	28 21	40·5	1·7	1·0	1·3	3·2
	29 21	37·5	0·5	−1·1	−0·5	2·2
	30 21	34·1	5·8	3·4	2·5	5·9
	31 21	35·1	4·9	2·7	2·9	3·9

From Tables LI. to XCVIII. we learn the following particulars. As the series of observations of the thermometer whose bulb was placed in the focus of the parabolic reflector extends over a much longer period of time than any of the others, it is desirable to discuss the results derived from it before consulting those deduced from the observations of the other instruments. Confining ourselves therefore to the numbers found from the observations of the thermometer in the reflector; first, to those in that division of every table under cloudy nights, it will be seen that during such nights its reading has frequently been higher than that in air, but it has generally been from 0° to 3° lower; frequently 4°; less frequently from 5° to 8°, and occasionally 9° less than that in air. In Tables LXXII., LXXIV. and LXXV., quantities equal to 9° are exhibited; and in the last-mentioned table there is one case of 13°·3; in Table XCI. there is one case of 11°·4; during the nights that these large differences have occurred the clouds have been noted as being fleecy, thin and high. In Table LXXXV. large differences are exhibited; the sky was noted at the time as being covered with cirrocumuli.

As the results on those nights during which more or less cloud prevailed are generally between those on cloudy and on cloudless nights, and nearly proportional to the amount of cloud; the next division of these tables, which deserves particular attention, is that containing the results derived from cloudless nights. By examining the numbers in this division, it will be found that quantities less than 5° have taken place, even on cloudless nights. The atmosphere, however, on such nights has been noticed as being thick, and the air as being saturated with moisture. The following is a list of these cases:—

The result deduced from the observation taken in the year	1841, on March 10, at 21h.
	1841, on March 29, at 21.
	1841, on June 20, at 21.
	1841, on July 9, at 21.
	1841, on September 6, at 21.
	1841, on November 19, at 21.
	1842, on April 8, at 21.
	1842, on August 3, at 21.
	1842, on August 16, at 21.
	1842, on August 17, at 21.
	1842, on August 28, at 21.
	1842, on December 5, at 21.
	1843, on October 26, at 21.
	1843, on December 17, at 21.
	1844, on March 12, at 21.
	1844, on March 23, at 21.
	1844, on May 20, at 21.
	1844, on June 16, at 21.

The result deduced from the observation taken in the year	1844, on July 16, at 21^h.
	1844, on August 13, at 21.
	1844, on August 14, at 21.
	1844, on October 7, 21.
	1844, on October 10, at 21.
	1844, on October 18, at 21.

In all twenty-five instances out of 331 cloudless nights; on one of these nights, viz. that preceding 1842, August 28, 21^h the result was a reading of 0°·6 higher than that of the thermometer in air, but it is very probable that the reading was in error.

The general amount on cloudless nights is from 7° to 10°; and frequently above 10°. During the four years' observations there were thirty-three cases in which the reading of the thermometer in air exceeded that of the thermometer in the reflector by quantities between 10° and 11°; there were nineteen cases between 11° and 12°; sixteen between 12° and 13°; eight between 13° and 14°; and there were four instances in which the excess amounted to 14° and was less than 15°; these cases occurred during the nights preceding 1842, June 16, 21^h and October 29, 21^h; 1843, February 12, 21^h and March 6, 21^h. (The differences in 1843 March were unusually large.) There were two cases exceeding 15°, both in 1842 on June 6 and 7; and there is one above 17° which occurred during the night preceding 1843 March 2, 21^h. This is the largest difference shown during the four years' observations, between the thermometer in the air and that in the reflector. I now proceed to speak of the results derived from the observations of the other instruments.

Those from cloudy nights with all the other thermometers were nearly the same as those with the thermometer with its bulb placed in the focus of the reflector, excepting that their readings were much less frequently higher than those of the thermometer in air than were those of that instrument.

On partially cloudy, and on cloudless nights, the reading of the thermometers on grass, those placed one inch above it, those on raw wool and flax, were always much lower than that in the reflector; and frequently, even on grass, the reading was as much below that in the reflector as the latter was below that in the air; on wool and flax it was nearly always so.

The greatest difference between the readings of that in air and that on short grass was 17°·8; and on long grass was 18°·8; and they took place during the night preceding 1844, October 3^d 21^h (see Table XCVI.). The reading of the thermometers which were placed on wool and flax were frequently from 15° to 18°, and occasionally from 19° to 21° less than that in air. The greatest difference with raw wool was 20°·4; and with flax was 21°·8, as observed 1844, April 24^d at 21^h, and on October 3^d at 21^h respectively.

The readings of the thermometer placed on garden mould were always (excepting when the sky was quite cloudy) nearer to that in the air than any of the other

readings mentioned in this section; and this reading was nearer and nearer to that in the air in proportion to the looseness of the mould; the heat from beneath passing the more rapidly to the surface in proportion to its looseness. It was also observed that the temperature about the roots of plants was lower in exact amount to the excess of heat conducted to the surface.

It must be borne in mind that the differences exhibited between the minimum readings of self-registering thermometers placed upon substances and fully exposed to the sky, and those of a similar thermometer placed in the air, and protected as much as possible from the sky, are not the maximum differences, unless the two minima occur at the same time; this generally is not the case; that of a thermometer placed on any substance and exposed to the sky usually occurs in the evening, or before midnight; whilst that in the air occurs at about the time of the rising of the sun. The difference between these two minima should be increased by the difference between the readings of the thermometer in the air at those times; this may amount to 10°; and it is highly probable that during a portion of the evening or night, which precedes the reading of the instruments, at times when 20° are exhibited between the minima, a difference of 30° has existed.

From the preceding remarks it is evident that the differences between the readings of the thermometer in air and the others, have varied with every variation of the amount of cloud; and by comparing the numbers in one table with those in another, it will be found that this difference is about the same in amount, with the same quantity of cloud at all times of the year.

This will be more clearly seen in the next table containing the monthly means of all the numbers contained in Tables LI. to XCVIII. of the results of the observations of the thermometer in the reflector.

Table XCIX.—Mean Monthly excess of the readings of the thermometer in Air above that in the Reflector.

General state of the sky during the night previous to reading the instruments.	Month.	The mean monthly excess, according to the state of the sky with respect to the quantity of cloud, of the readings of a self-registering thermometer placed in air at the height of 4 feet and protected from radiation, above those of a similar thermometer placed in the focus of a metallic parabolic reflector.										
		1841.		1843.		1845.		1844.		1841 Feb. 10, to 1844 Dec. 31.		
		Mean excess.	No. of nights.	Mean excess.	No. of nights.	Mean excess.	No. of nights.	Mean excess.	No. of nights.	No. of nights.	Sum of excess.	Mean excess.
		°		°		°		°				°
Cloudless.	January.	.....	.....	9·4	6	9·5	8	8·0	2	16	148·7	9·3
	February.	5·8	1	8·1	4	11·0	5	7·0	4	14	121·4	8·7
	March.	7·1	12	6·5	8	10·2	15	6·5	7	42	336·2	8·0
	April.	9·4	7	7·1	9	10·1	11	8·0	18	45	384·9	8·1
	May.	7·2	7	8·5	8	10·5	2	9·1	10	27	219·7	8·1
	June.	8·8	4	10·2	12	10·3	7	6·8	6	29	267·5	9·2
	July.	7·4	4	8·7	6	10·1	2	8·2	12	24	199·9	8·3
	August.	9·9	4	6·2	11	9·1	6	7·1	12	33	247·6	7·5
	September.	8·1	6	4·5	3	9·2	11	9·7	12	32	279·0	8·7
	October.	8·7	5	9·1	9	6·6	8	6·8	8	30	227·7	7·6
	November.	8·1	9	10·6	3	8·5	6	6·0	2	20	167·7	8·4
	December.	8·7	7	6·6	6	.....	0	9·3	6	19	156·0	8·2
Principally cloudless.	January.	.....	.....	6·2	7	7·3	3	4·6	7	17	97·2	5·7
	February.	.....	0	5·8	5	7·2	2	5·5	6	13	76·5	5·9
	March.	6·1	5	6·6	3	8·4	5	4·9	2	15	101·6	6·8
	April.	5·8	6	5·1	7	7·4	6	7·4	4	23	144·4	6·3
	May.	7·0	4	6·7	10	7·8	4	6·0	5	26	179·7	6·9
	June.	7·4	6	6·4	8	7·6	6	7·7	5	26	187·6	7·2
	July.	4·7	3	6·5	13	8·4	10	7·1	1	26	180·9	6·9
	August.	5·6	6	5·7	4	8·1	12	7·5	6	28	198·2	7·1
	September.	5·5	4	5·7	9	9·2	11	8·6	5	24	169·1	7·0
	October.	7·0	1	6·7	8	6·6	8	6·8	6	23	157·7	6·9
	November.	7·2	2	7·5	11	7·1	7	8·1	7	28	210·7	7·5
	December.	7·1	5	6·2	6	6·1	5	8·2	1	18	111·3	6·2
Half-cloudy.	January.	.....	.....	5·8	7	6·0	6	4·4	5	18	96·8	5·4
	February.	3·2	1	3·6	7	8·4	5	3·7	6	19	106·7	5·6
	March.	5·1	5	4·2	11	7·3	3	4·4	9	28	132·9	4·7
	April.	5·6	6	4·8	8	5·3	8	3·4	3	25	125·4	5·0
	May.	5·1	6	6·1	5	5·1	4	5·9	6	21	117·3	5·6
	June.	5·3	6	5·8	7	5·5	9	5·0	7	21	115·4	5·5
	July.	4·7	6	4·9	6	6·6	7	6·3	5	24	134·9	5·6
	August.	5·8	6	5·2	11	6·5	7	7·5	5	29	174·6	6·0
	September.	4·7	16	4·2	9	7·2	7	12·0	2	34	197·6	5·8
	October.	4·1	11	6·1	4	5·4	6	6·0	6	26	137·9	5·3
	November.	6·1	6	6·0	5	4·6	1	7·6	6	24	153·0	6·4
	December.	5·8	9	5·1	3	7·9	1	.....	0	13	75·3	5·8
Principally cloudy.	January.	.....	.....	3·8	2	4·6	6	2·6	7	15	53·6	3·6
	February.	3·9	2	3·1	6	4·9	3	3·1	6	17	59·7	3·5
	March.	3·2	5	1·6	1	10·5	1	4·2	5	12	48·8	4·1
	April.	2·2	6	3·3	1	2·8	1	7·3	2	10	34·6	3·5
	May.	2·1	8	5·0	5	5·8	6	6·0	5	20	74·7	3·7
	June.	3·0	5	5·8	1	5·5	9	−1·3	1	25	130·8	5·2
	July.	2·9	11	3·8	3	4·6	6	4·8	9	29	113·5	3·9
	August.	3·6	7	3·6	1	7·0	2	7·9	1	11	50·5	4·6
	September.	4·2	2	2·6	4	6·6	3	6·3	5	14	70·7	5·1
	October.	2·8	9	4·6	3	4·6	3	6·3	1	16	59·5	3·7
	November.	2·5	9	4·4	2	1·5	2	5·7	3	15	51·6	3·4
	December.	3·7	6	8·0	1	5·7	7	.....	0	14	70·3	5·0
Cloudy.	January.	.....	.....	2·3	10	3·4	5	0·7	8	20	45·8	2·0
	February.	2·1	19	1·8	5	3·3	11	3·3	7	42	109·0	2·6
	March.	0·6	3	1·9	8	5·3	7	1·8	8	26	68·1	2·6
	April.	1·9	4	1·4	5	2·8	4	2·1	3	16	32·3	2·0
	May.	0·4	6	1·9	3	2·6	12	4·1	9	30	80·0	2·7
	June.	0·3	6	1·2	2	3·2	6	3·7	2	16	27·8	1·7
	July.	0·8	7	3·7	3	3·8	5	3·1	4	19	48·4	2·6
	August.	0·6	8	2·0	3	3·0	2	4·4	7	20	54·0	2·7
	September.	2·6	2	2·0	5	5·1	3	5·4	5	15	57·7	3·8
	October.	1·5	5	2·7	7	2·4	6	4·7	10	28	88·4	3·2
	November.	2·4	3	4·0	6	2·0	8	2·9	11	28	79·1	2·8
	December.	4·3	3	2·8	15	3·3	17	3·4	23	56	188·8	3·3

The numbers contained in this table show very clearly that, under the same state of the sky, the excess of the reading of the thermometer in air above that in the reflector is the same at all times of the year, and they as clearly show that the amount of the excess varies with every variation of the quantity of cloud. These results are exhibited in each year; and they are very decidedly shown in the last column of each division of the table, which contains the mean results for every month derived from the four years' observations, excepting in January, which was deduced from three years only.

Table C. is formed from the numbers in Table XCIX. by taking their yearly values for each state of the sky. The last column of this table contains the mean result from all the observations which were spread over 1419 nights; in the year 1841 there was one observation lost; in 1842 there were fifteen; in 1843 there were nine, and in 1844 there were six. These observations were lost chiefly from the instrument being out of repair, or the having omitted to set the index the previous day. The result in the last column is therefore deduced from 1389 nights, and include those from all states of the sky and weather.

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TABLE C.—Showing the mean results in each year, with the different states of the sky, and for the whole time derived from all the self-registering observations of the thermometer whose bulb was placed in the focus of a metallic parabolic reflector.

State of the sky.	The mean yearly excess, according to the state of the sky with respect to the quantity of cloud, of the readings of a self-registering thermometer placed in air at the height of 4 feet and protected from radiation, above those of a similar thermometer placed in the focus of a metallic parabolic reflector fully exposed to the sky.																	
	1841.			1842.			1843.			1844.			1840 February 10, to 1844 December 31.					
	Whole sum of excesses.	Whole number of nights.	Mean excess.	Whole sum of excesses.	Whole number of nights.	Mean excess.	Whole sum of excesses.	Whole number of nights.	Mean excess.	Whole sum of excesses.	Whole number of nights.	Mean excess.	Whole number of nights.	Sum of excesses.	Mean excess.	Whole number of nights.	Sum of excesses.	Mean excess per night.
Cloudy	97·3	66	1·47	177·8	72	2·47	281·4	86	3·27	323·9	97	3·33	321	879·4	2·74			
Principally cloudy	203·9	70	2·91	118·8	30	3·96	258·2	49	5·27	237·4	49	4·85	198	818·3	4·13			
Half-cloudy	396·0	78	5·08	430·5	82	5·25	394·9	62	6·37	336·4	60	5·60	282	1557·8	5·52	1389	7826·4	5·65
Principally clear	270·8	43	6·30	578·4	81	7·14	591·1	78	7·58	374·4	55	6·81	257	1814·7	7·06			
Cloudless	535·9	66	8·12	682·1	85	8·03	768·1	81	9·48	770·1	99	7·78	331	2756·2	8·33			

By considering that the cloudy nights in this table are represented by 10; the principally cloudy by 8; the half-cloudy by 5; the principally clear by 2; and the cloudless by 0, the following particulars may be deduced from this table.

The sum of the products of the above numbers into the number of nights of each class in each year, divided by the number of nights in the year, gives the mean state of cloudiness during the nights of that year; and the yearly sum of the excess of the reading of the thermometer in air above that placed in the reflector, divided by the number of nights in the year, gives the excess, corresponding to the mean state of cloudiness; and thus we find

In the year 1841	The mean state of cloudiness during the nights was	5·8,	and the mean excess of the reading of the thermometer in the air above that in the reflector was		4·7
In the year 1842	„	4·4,	„		5·7
In the year 1843	„	4·9,	„		6·4
In the year 1844	„	5·0,	„		5·7

And the mean state of cloudiness during the nights of the four years was 5 (or the sky upon the average had been one-half covered by cloud), and the corresponding mean excess of the reading of the thermometer in air above that in the reflector was 5°·65.

In the year 1841 the number of clear and cloudy nights were equal; and they were nearly the same in number in the year 1844; in the year 1842 the number of clear nights exceeded the number of cloudy nights by thirteen; and in 1843 the cloudy exceeded the clear nights by five: from this it appears that during these four years there were one clear and one cloudy night out of every four nights.

In Table XLV. the relative less reading of a thermometer placed on raw wool and one in the focus of a parabolic reflector, than that in the air was found to be as 1221 : 888 from 889 simultaneous observations.

In Table CVI. this ratio is found to be as 1280 : 962 from 992 observations, deduced from self-registering minimum thermometers. As these results are so nearly identical, and as they have been deduced by entirely different instruments, there can be but little doubt of the correctness of their mean, viz. 1251 : 910, or in other words, the results as derived from the observations of the thermometer in the reflector, would be converted into results as deduced from placing a thermometer on raw wool by multiplying the former by 1·375, and in this way we should derive 7°·76 (*i. e.* 5°·65 × 1·375) as the mean deduced from the four years' observations; and we should find 11°·5 (*i. e.* 8°·33 × 1·375) as that deduced from cloudless nights. I have preferred exhibiting these results in terms of that derived from raw wool in consequence of it being free from the effects of heat conducted from the earth, and therefore free from one of the many sources from which the reading of a thermometer placed on the ground is affected, some of which are as follows:—

From the heat of the earth upon which it is placed.

From the heat radiated to it from lateral objects.

From the heat communicated to the substance from the air in contact with it.

From the heat evolved during the change of the watery vapour in the atmosphere into dew.

From the heat received from the radiation from clouds.

From the heat received from the upper regions of the atmosphere, and

From the heat received from space.

By placing a thermometer on wool the effect of the first of these causes is evaded, as appears in a previous section; in a wide and open plain the second would be evaded, as there would be but few objects to emit heat; I fear, however, that all my

readings are affected from this cause, and to an unknown amount; the heat of the air is known, and therefore it can be accounted for; the amount of heat evolved during the change of vapour into water appears to be about 4° from all the experiments I have made; the heat radiated from dense clouds, near the earth, must be very nearly the same in amount as that radiated from the earth, as the clouds when at a low elevation must possess very nearly the same heat as that of the lower atmosphere; but when such clouds are high their temperature must be less than when at a low elevation, and they will radiate less heat to the earth than they will receive from it (see the following experiments upon the different results deduced from high and low clouds, of the same modification and covering the same extent of sky); and the amount of heat from the other sources is unknown. The whole effect of all these checks upon the production of a great cold at night, by the radiation of heat from bodies on the surface of the earth, cannot be estimated, yet, notwithstanding their operation, the reading of a thermometer placed on the ground has been frequently very low. The reading of a thermometer thus placed represents the amount of heat received from all the above sources, diminished by the amount radiated from itself.

The place in which the observations were taken is not favourably situated for the production of a great cold, from radiation of heat at night, it being surrounded, at no great distance, by large trees, and consequently the humidity of the atmosphere is great.

From the circumstance of low readings always having taken place when the sky has been cloudless and bright, we may readily infer that the temperature of space must be very low indeed.

The reading of a thermometer placed on grass is much affected by the heat conducted to it from the earth beneath; yet, notwithstanding, its readings were always less than those of the thermometer in the reflector, in the ratio of 1000 : 858 (see Table XLV.), therefore it is necessary to multiply the results derived from the latter by 1·17 to reduce them to results that would have been derived from the former.

By examining the numbers in the columns under the lowest thermometrical readings in Table CVII., it appears that long grass, and therefore vegetation is liable to be affected at night from the influence of radiation by a temperature below the freezing-point of water every month in the year, for even in July 1844, the only exception in that year, the thermometer read 35°·5, whilst that in the reflector read 39°·3; in the year 1843, in July, the reading in the reflector was as low as 35°·2, and it seems very probable that long grass temperature at this time was at or below 32°; and as all the readings would have been lower if the experiments had been made in the open country, it seems certain that vegetation is always liable to the temperature of 32° in this country.

The next table is formed by taking the means of all the numbers contained in each division of the Tables LXXVIII. to XCVIII.

TABLE CI.—Showing the mean monthly excess of the reading of a self-registering minimum thermometer in Air at the height of 4 feet, above the

General state of the sky during the night previous to reading the instruments.	Year.	Month.	The mean excess in each month, according to the state of the sky with respect to the quantity of cloud, of the readings of a self-registering minimum thermometer placed in air at the height of 4 feet and protected											
			On long grass exposed to $\frac{3}{4}$ths of the sky.		On long grass.		On short grass.		On garden mould.		In air one inch high.		In air three inches high.	
			Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.
Cloudless.	1843.	April.	$8{\cdot}1$	1	°	...	$8{\cdot}5$	1	$5{\cdot}6$	3	$8{\cdot}6$	1	$7{\cdot}9$	1
		May.	6·0	2	...	...	10·2	2	4·0	2	11·4	2	7·7	2
		June.	6·5	7	...	...	9·7	7	5·5	7	10·5	7	11·3	7
		July.	7·4	2	...	...	12·7	2	10·0	1	12·0	2	10·0	2
		August.	5·8	6	...	...	10·6	6	...	...	10·8	6	10·9	6
		September.	7·1	4	11·4	7	10·0	11	...	...	8·8	11	6·9	11
		October.	...	...	8·0	8	6·4	8	...	...	5·3	8	...	...
		November.	...	...	9·9	6	8·0	6	...	...	6·3	1	...	...
		December.	...	...	...	0	...	0	...	...	...	0	...	...
	1844.	January.	...	...	9·5	2	9·9	1	...	...	...	...	...	...
		February.	...	...	9·6	4	7·1	4	...	...	...	...	...	...
		March.	...	...	8·3	7	6·2	7	...	...	...	...	...	...
		April.	...	...	11·8	18	10·7	18	...	...	...	...	...	...
		May.	...	...	11·3	10	10·6	10	...	...	...	...	...	...
		June.	...	...	9·3	7	8·0	7	...	...	...	...	...	...
		July.	...	...	10·9	12	9·1	12	...	...	...	...	...	...
		August.	...	...	8·9	12	7·6	12	...	...	...	...	...	...
		September.	...	...	10·5	12	8·7	12	...	...	...	...	...	...
		October.	...	...	10·7	8	8·7	8	...	...	...	...	...	...
		November.	...	...	10·1	2	5·4	2	...	...	...	...	...	...
		December.	...	...	11·0	6	7·2	6	...	...	...	...	...	...
Principally clear.	1843.	April.	...	...	...	...	11·0	2	2·3	2	...	...	...	...
		May.	4·5	7	...	...	5·0	7	3·3	7	7·6	7	6·7	7
		June.	3·5	7	...	...	6·0	7	2·9	7	8·3	7	7·9	7
		July.	5·9	10	...	...	5·9	10	7·0	1	7·1	9	7·3	10
		August.	4·7	12	...	...	7·1	12	...	...	6·9	12	7·2	12
		September.	7·4	1	8·8	2	9·7	5	...	...	9·1	5	9·5	5
		October.	...	...	8·0	8	7·1	8	...	...	5·9	8	...	...
		November.	...	...	8·9	7	6·2	6	...	...	4·4	4	...	...
		December.	...	...	7·1	5	6·5	4	...	...	...	...	...	...
	1844.	January.	...	...	8·5	7	7·4	7	...	...	...	...	...	...
		February.	...	...	7·5	6	5·8	6	...	...	...	...	...	...
		March.	...	...	6·6	2	5·6	2	...	...	...	...	...	...
		April.	...	...	10·3	4	9·1	4	...	...	...	...	...	...
		May.	...	...	9·8	5	9·5	5	...	...	...	...	...	...
		June.	...	...	8·8	5	9·0	5	...	...	...	...	...	...
		July.	...	...	8·8	1	10·0	1	...	...	...	...	...	...
		August.	...	...	8·1	6	6·0	6	...	...	...	...	...	...
		September.	...	...	10·8	4	9·9	4	...	...	...	...	...	...
		October.	...	...	9·5	6	8·1	6	...	...	...	...	...	...
		November.	...	...	9·6	7	7·2	7	...	...	...	...	...	...
		December.	...	...	7·2	1	5·7	1	...	...	...	...	...	...
Half-cloudy.	1843.	April.	4·7	1	...	...	6·2	3	3·3	3	4·7	1	4·2	1
		May.	4·1	4	...	...	6·6	4	4·2	4	7·1	4	7·6	4
		June.	3·8	1	...	...	7·3	1	4·0	1	10·8	1	10·6	1
		July.	3·8	7	...	...	6·2	7	4·5	1	5·9	7	6·4	7
		August.	4·5	7	...	...	6·0	7	...	...	5·6	7	6·0	7
		September.	4·7	2	9·4	5	8·1	7	...	...	6·5	7	4·8	7
		October.	...	...	6·3	6	5·6	6	...	...	4·8	6	3·3	1
		November.	...	...	4·5	7	5·6	6	...	...	3·8	1	...	...
		December.	...	...	7·1	1	6·1	1	...	...	...	...	...	...
	1844.	January.	...	...	7·4	5	5·9	5	...	...	...	...	...	...
		February.	...	...	6·2	6	4·6	6	...	...	...	...	...	...
		March.	...	...	6·5	9	4·7	9	...	...	...	...	...	...
		April.	...	...	6·2	3	6·0	3	...	...	...	...	...	...
		May.	...	...	5·5	9	5·4	9	...	...	...	...	...	...
		June.	...	...	7·7	7	7·6	7	...	...	...	...	...	...
		July.	...	...	9·7	5	6·8	4	...	...	...	...	...	...
		August.	...	...	8·4	4	6·4	4	...	...	...	...	...	...
		September.	...	...	10·5	12	8·7	12	...	...	...	...	...	...
		October.	...	...	7·6	6	6·7	6	...	...	...	...	...	...
		November.	...	...	8·0	6	6·4	6	...	...	...	...	...	...
		December.	...	...	...	0	...	0	...	...	...	...	...	...

readings of a similar thermometer placed on different substances, in each state of the sky.

from the effects of radiation, above that of a similar thermometer fully exposed to the sky, placed

In air six inches high.		On white raw wool.		On fine flax.		On coarse flax.		On white unwrought cotton wool.		On lead.		On blackened tin.		On white tin.		In focus of metallic parabolic reflector.	
Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.
°		°		°		°		°		°		°		°		°	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10·1	11
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10·5	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10·3	7
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10·1	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9·1	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9·2	11
...	...	11·7	7	11·0	7	10·0	7	9·4	7	...	...	...	...	...	...	6·6	8
...	...	12·3	5	11·5	6	12·3	5	11·9	4	...	...	...	...	...	...	8·5	6
...	...	...	0	...	0	...	...	...	...	...	...	...	0	...	0	...	0
...	...	13·4	1	10·6	1	...	...	...	...	...	...	9·6	1	8·9	1	8·0	2
...	...	8·8	4	9·1	4	...	...	...	...	...	...	7·6	4	7·7	4	7·0	4
...	...	11·2	7	9·8	7	...	...	...	...	5·9	7	...	...	...	...	6·5	7
...	...	15·3	18	16·2	18	...	...	...	...	9·2	18	...	...	...	...	8·0	18
...	...	11·9	10	13·2	10	...	...	...	...	9·6	4	...	...	...	...	8·1	10
...	...	8·3	4	7·8	4	...	...	...	...	...	...	...	...	...	...	6·8	6
...	...	12·3	9	13·1	9	...	...	...	...	...	...	...	...	...	...	8·2	12
...	...	8·6	12	9·8	12	...	...	...	...	...	...	...	...	...	...	7·1	12
...	...	...	...	12·6	12	...	...	...	...	...	...	...	...	...	...	9·7	12
...	...	...	...	12·4	8	...	...	...	...	...	...	...	...	...	...	6·8	8
...	...	...	...	9·7	2	...	...	...	...	...	...	...	...	...	...	6·0	2
...	...	...	...	12·3	6	...	...	...	...	...	...	...	...	...	...	9·3	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·4	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·8	4
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·6	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8·4	10
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8·1	12
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9·2	11
3·1	8·0	8·8	2	9·3	2	8·9	2	8·6	2	...	...	...	...	...	...	6·6	8
...	...	9·5	7	9·1	7	9·5	5	8·0	5	...	...	...	...	...	...	7·1	7
...	...	7·6	5	7·0	5	...	...	...	...	...	...	5·9	5	4·9	5	6·1	5
...	...	10·8	7	8·6	7	...	...	...	...	...	...	8·0	7	7·3	7	4·6	7
...	...	7·9	6	7·9	6	...	...	...	...	...	...	7·0	6	6·8	6	5·5	6
...	...	7·5	2	7·8	2	...	...	...	...	5·2	2	...	...	...	...	4·9	2
...	...	13·1	4	14·5	4	...	...	...	...	10·1	4	...	...	...	...	7·4	4
...	...	11·4	4	9·1	4	...	...	...	...	...	...	...	...	...	...	6·0	5
...	...	10·3	4	10·4	5	...	...	...	...	...	...	...	...	...	...	7·7	5
...	...	12·9	1	13·1	1	...	...	...	...	...	...	...	...	...	...	7·1	1
...	...	8·1	6	8·3	6	...	...	...	...	...	...	...	...	...	...	7·5	6
...	...	...	...	12·5	4	...	...	...	...	...	...	...	...	...	...	8·6	5
...	...	...	...	10·4	6	...	...	...	...	...	...	...	...	...	...	8·8	6
...	...	...	...	10·1	7	...	...	...	...	...	...	...	...	...	...	8·1	7
...	...	...	...	7·1	1	...	...	...	...	...	...	...	...	...	...	8·2	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·3	8
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·1	4
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·5	9
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6·6	7
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6·5	7
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·2	7
4·2	3·0	5·4	2	4·6	2	4·8	2	4·0	2	5·0	...	...	...	...	...	5·4	6
...	...	6·5	6	8·0	4	8·6	1	4·8	2	...	...	...	...	...	...	4·6	1
...	...	6·9	1	...	...	7·3	1	...	...	...	...	5·9	1	5·9	1	7·9	1
...	...	9·1	5	5·4	5	...	...	...	...	...	...	6·8	5	5·4	5	4·4	5
...	...	4·2	6	5·0	6	...	...	...	...	...	...	5·1	6	4·5	6	3·7	6
...	...	6·7	8	6·9	8	...	...	...	...	5·3	8	...	...	...	...	4·4	9
...	...	8·2	3	8·8	3	...	...	...	...	4·6	3	...	...	...	...	3·4	3
...	...	8·7	4	8·4	4	...	...	...	...	...	...	...	...	...	...	5·9	6
...	...	7·9	2	6·6	4	...	...	...	...	...	...	...	...	...	...	5·0	7
...	...	8·1	3	8·3	3	...	...	...	...	...	...	...	...	...	...	6·3	5
...	...	11·0	4	11·9	4	...	...	...	...	...	...	...	...	...	...	7·5	5
...	...	...	...	12·6	10	...	...	...	...	...	...	...	...	...	...	12·0	2
...	...	...	...	9·3	6	...	...	...	...	...	...	...	...	...	...	6·0	6
...	...	...	...	8·9	6	...	...	...	...	...	...	...	...	...	...	7·6	6
...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...	...	0

Table (Continued).

General state of the sky during the night previous to reading the instruments.	Year.	Month.	The mean excess in each month, according to the state of the sky with respect to the quantity of clouds, of the readings of a self-registering minimum thermometer placed in air at the height of 4 feet and protected											
			On long grass exposed to 5ths of the sky.		On long grass.		On short grass.		On garden mould.		In air one inch high.		In air three inches high.	
			Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.
			°		°		°		°		°		°	
Principally cloudy.	1843.	April.	...	...	...	...	...	...	...	...	...	...	...	...
		May.	3·8	6	...	...	3·6	6	3·1	6	5·8	6	5·6	6
		June.	4·5	9	...	...	4·8	9	4·4	9	5·2	9	6·0	9
		July.	3·3	6	...	...	3·1	6	...	...	4·3	5	4·0	6
		August.	5·1	2	...	...	7·0	2	...	...	6·8	2	7·3	2
		September.	5·4	1	6·2	1	5·0	3	...	...	4·0	3	3·6	3
		October.	...	...	6·6	3	4·0	3	...	...	3·4	3	3·3	2
		November.	...	...	3·8	2	4·0	2	...	...	...	...	...	...
		December.	...	...	6·1	7	5·7	7	...	...	...	...	...	...
	1844.	January.	...	...	6·9	7	6·2	7	...	...	...	...	...	...
		February.	...	...	5·6	6	3·4	6	...	...	...	...	...	...
		March.	...	...	6·6	5	5·1	5	...	...	...	...	...	...
		April.	...	...	9·5	2	8·9	2	...	...	...	...	...	...
		May.	...	...	5·2	1	4·7	1	...	...	...	...	...	...
		June.	...	...	8·7	10	7·9	10	...	...	...	...	...	...
		July.	...	...	7·5	9	7·2	9	...	...	...	...	...	...
		August.	...	...	4·9	7	4·4	7	...	...	...	...	...	...
		September.	...	...	6·6	5	5·2	5	...	...	...	...	...	...
		October.	...	...	5·6	1	5·8	1	...	...	...	...	...	...
		November.	...	...	6·0	3	3·8	3	...	...	...	...	...	...
		December.	...	...	...	0	...	0	...	...	...	...	...	...
Cloudy.	1843.	April.	5·7	2	...	...	6·8	2	4·2	2	5·4	2	5·2	2
		May.	3·7	12	...	...	2·8	12	2·1	12	3·7	12	4·8	12
		June.	2·3	5	...	...	1·5	5	1·2	5	2·9	5	3·1	5
		July.	3·0	5	...	...	2·1	5	...	...	2·9	4	2·3	5
		August.	1·5	2	...	...	1·2	2	...	...	1·5	2	1·7	2
		September.	3·0	3	...	...	2·9	3	...	...	3·1	3	3·1	3
		October.	3·7	5	3·7	5	4·2	5	...	...	1·1	5	...	...
		November.	...	...	2·1	8	1·7	7	...	...	1·9	2	...	...
		December.	...	...	3·0	17	2·8	17	...	...	...	...	...	...
	1844.	January.	...	...	3·5	8	2·9	7	...	...	...	...	...	...
		February.	...	...	3·9	7	3·6	7	...	...	...	...	...	...
		March.	...	...	3·2	8	2·8	8	...	...	...	...	...	...
		April.	...	...	2·6	3	2·6	3	...	...	...	...	...	...
		May.	...	...	5·5	9	5·4	9	...	...	...	...	...	...
		June.	...	...	1·7	2	1·6	2	...	...	...	...	...	...
		July.	...	...	3·2	4	2·2	4	...	...	...	...	...	...
		August.	...	...	4·9	7	4·4	7	...	...	...	...	...	...
		September.	...	...	3·1	6	2·9	6	...	...	...	...	...	...
		October.	...	...	5·3	10	4·2	10	...	...	...	...	...	...
		November.	...	...	3·2	12	2·5	12	...	...	...	...	...	...
		December.	...	...	2·7	23	1·1	23	...	...	...	...	...	...

TABLE (Continued).

from the effects of radiation, above that of a similar thermometer fully exposed to the sky, placed																	
In air six inches high.		On white raw wool.		On fine flax.		On coarse flax.		On white unwrought cotton wool.		On lead.		On blackened tin.		On white tin.		In focus of metallic parabolic reflector.	
Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.	Mean excess.	Number of nights.
°		°		°		°		°		°		°		°		2·8	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·8	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·5	9
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4·6	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7·0	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6·6	3
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4·6	3
...	...	2·5	1	2·5	1	2·5	1	...	...	...	...	...	...	...	...	1·5	2
...	...	4·5	2	4·3	2	...	...	...	...	...	...	...	...	...	...	5·7	7
...	...	6·0	7	...	...	6·1	7	...	...	...	...	5·1	7	4·0	6	2·6	7
...	...	7·0	7	5·6	7	...	...	...	...	...	...	6·7	7	6·3	7	3·1	6
...	...	7·4	6	6·8	6	...	...	...	...	...	...	4·9	6	4·6	6	4·2	5
...	...	8·0	5	7·3	5	...	...	...	...	5·3	1	...	...	...	...	7·3	2
...	...	12·3	2	13·2	2	...	...	...	...	9·0	2	...	...	...	...	6·0	5
...	...	8·7	1	8·7	1	...	...	...	...	...	...	...	...	...	...	−1·3	1
...	...	9·1	8	9·0	8	...	...	...	...	...	...	...	...	...	...	4·6	9
...	...	8·5	7	7·7	7	...	...	...	...	...	...	...	...	...	...	7·9	1
...	...	6·5	5	6·0	6	...	...	...	...	...	...	...	...	...	...	6·3	5
...	...	...	...	7·6	5	...	...	...	...	...	...	...	...	...	...	6·3	1
...	...	...	...	8·8	1	...	...	...	...	...	...	...	...	...	...	5·7	3
...	...	...	...	6·6	3	...	...	...	...	...	...	...	...	...	...	...	0
...	...	...	...	...	0	...	...	...	...	...	...	...	...	...	...		
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2·8	4
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2·6	12
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3·2	6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3·8	5
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3·9	2
2·0	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·1	3
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2·4	6
...	...	3·3	7	2·0	5	2·9	4	2·1	4	...	...	2·2	15	2·4	16	2·0	8
...	...	2·4	17	...	...	3·0	17	...	...	...	...	3·5	7	3·7	7	3·3	17
...	...	3·6	8	2·5	8	...	...	...	...	...	...	5·5	6	4·6	6	0·7	8
...	...	4·7	6	5·1	6	...	...	...	...	...	...	...	...	...	...	3·3	7
...	...	3·5	8	3·8	8	...	...	...	...	2·9	8	...	...	...	...	1·8	8
...	...	5·2	3	4·9	3	...	...	...	...	2·6	3	...	...	...	...	2·1	3
...	...	9·7	4	9·4	4	...	...	...	...	...	...	...	...	...	...	4·1	9
...	...	1·8	2	2·5	2	...	...	...	...	...	...	...	...	...	...	3·7	2
...	...	3·3	3	3·6	3	...	...	...	...	...	...	...	...	...	...	3·1	4
...	...	6·5	5	6·0	6	...	...	...	...	...	...	...	...	...	...	4·4	7
...	...	...	...	3·5	6	...	...	...	...	...	...	...	...	...	...	5·4	5
...	...	...	...	7·1	10	...	...	...	...	...	...	...	...	...	...	4·7	10
...	...	...	...	2·5	12	...	...	...	...	...	...	...	...	...	...	2·9	11
...	...	...	...	2·4	23	...	...	...	...	...	...	...	...	...	...	3·4	23

The following Table contains the mean of the values in each year, and for the whole time according to the number of observations.

TABLE CII.—Showing the excess of reading of the thermometer in Air, above those placed as stated in the 2nd column, in each of the years 1843 and 1844, and for both years together.

General state of the sky during the night previous to reading the instruments.	Situation of the thermometer.	The mean yearly excess, according to the state of the sky, of the reading of a self-registering minimum thermometer placed in air at the height of 4 feet, and protected from radiation, above that of a similar thermometer placed on different substances.								
		1843.			1844.			1843 and 1844.		
		Number of nights.	Sum of excesses.	Mean excess.	Number of nights.	Sum of excesses.	Mean excess.	Whole number of nights.	Whole sum of excesses.	Mean excess.
Cloudy.	On long grass exposed to $\frac{3}{4}$ths of the sky	29	95°6	3°3	...	.....	...	29	95°6	3°3
	On long grass fully exposed to the sky	30	85·9	2·9	99	360·2	3·7	129	446·1	3·4
	On short grass fully exposed to the sky	58	159·5	2·8	98	281·6	2·9	156	441·1	2·8
	On garden mould	29	40·2	1·4	...	.....	...	29	40·2	1·4
	One inch above grass	34	103·0	3·0	...	.....	...	34	103·0	3·0
	Three inches above grass	31	111·5	3·6	...	.....	...	31	111·5	3·6
	Six inches above grass	...	.....	...	...	.....	...	...	.....	...
	On white raw wool	25	70·6	2·8	40	186·5	4·7	65	257·1	3·9
	On fine flax	6	15·7	2·6	92	363·8	4·0	98	379·5	3·9
	On coarse flax	22	67·6	3·1	...	.....	...	22	67·6	3·1
	On white unwrought cotton wool	5	11·2	2·2	...	.....	...	5	11·2	2·2
	On lead	...	.....	...	11	31·0	2·8	11	31·0	2·8
	On blackened tin	15	33·5	2·2	14	62·7	4·5	29	96·2	3·3
	On white tin	16	38·4	2·4	14	50·7	3·6	40	89·1	2·2
	In focus of metallic reflector	86	281·4	3·3	97	322·9	3·3	183	604·3	3·3
Principally cloudy.	On long grass exposed to $\frac{3}{4}$ths of the sky	25	101·2	4·1	...	.....	...	25	101·2	4·0
	On long grass fully exposed to the sky	13	76·9	5·9	50	354·7	7·1	63	431·6	6·8
	On short grass fully exposed	39	181·8	4·6	50	303·3	6·1	89	485·1	5·5
	On garden mould fully exposed	16	59·7	3·7	...	.....	...	16	59·7	3·7
	One inch above grass	28	146·0	5·2	...	.....	...	28	146·0	5·2
	Three inches above grass	29	149·0	5·1	...	.....	...	29	149·0	5·2
	Six inches above grass	...	.....	...	...	.....	...	...	.....	...
	On white raw wool	10	53·9	5·4	37	302·0	8·2	47	355·9	7·5
	On fine flax	3	11·1	3·7	46	352·9	7·7	49	364·0	7·4
	On coarse flax	8	45·4	5·7	...	.....	...	8	45·4	5·7
	On white unwrought cotton wool	1	6·5	6·5	...	.....	...	1	6·5	6·5
	On lead	...	.....	...	7	44·3	6·3	7	44·3	6·3
	On blackened tin	7	36·1	5·1	13	75·8	5·8	20	111·9	5·6
	On white tin	6	24·2	4·0	13	71·7	5·3	19	95·9	5·0
	In focus of metallic reflector	49	258·2	5·3	49	237·4	4·9	98	495·6	5·1
Half-cloudy.	On long grass exposed to $\frac{3}{4}$ths of the sky	22	88·6	4·0	...	.....	...	22	88·6	4·0
	On long grass fully exposed	19	120·7	6·4	58	438·4	7·6	77	559·1	7·3
	On short grass	42	267·3	6·4	57	353·6	6·2	99	620·9	6·3
	On garden mould	10	39·7	4·0	...	.....	...	10	39·7	3·9
	One inch above grass	34	202·5	5·9	...	.....	...	34	202·5	5·9
	Three inches above grass	28	168·9	6·0	...	.....	...	28	168·9	6·0
	Six inches above grass	3	12·5	4·2	...	.....	...	3	12·5	4·2
	On white raw wool	9	56·6	6·3	33	250·7	7·6	42	307·3	7·3
	On fine flax	11	41·2	3·7	49	383·9	7·8	60	425·1	7·1
	On coarse flax	4	25·5	6·4	...	.....	...	4	25·5	6·4
	On white unwrought cotton wool	4	17·6	4·4	...	.....	...	4	17·6	4·4
	On lead	...	.....	...	14	70·7	5·1	14	70·7	5·1
	On blackened tin	1	5·9	5·9	11	64·5	5·9	12	70·4	5·9
	On white tin	1	5·9	5·9	11	53·9	4·9	12	59·8	5·0
	In focus of metallic reflector	62	394·9	6·4	60	336·4	5·6	122	731·3	6·0

TABLE (Continued).

General state of the sky during the night previous to reading the instruments.	Situation of the thermometer.	The mean yearly excess, according to the state of the sky, of the reading of a self-registering minimum thermometer placed in air at the height of 4 feet, and protected from radiation, above that of a similar thermometer placed on different substances.								
		1843.			1844.			1843 and 1844.		
		Number of nights.	Sum of excesses.	Mean excess.	Number of nights.	Sum of excesses.	Mean excess.	Whole number of nights.	Whole sum of excesses.	Mean excess.
			°	°		°	°		°	°
Principally clear.	On long grass exposed to $\frac{1}{4}$ths of the sky	37	178·5	4·8	...	.....	...	37	178·5	4·8
	On long grass fully exposed to the sky	22	179·2	8·1	55	195·2	9·0	77	374·4	4·9
	On short grass	61	410·7	6·7	55	427·7	7·8	116	838·4	7·2
	On garden mould	17	55·6	3·3	...	.....	...	17	55·6	3·3
	One inch above grass	52	368·3	7·1	...	.....	...	52	368·3	7·1
	Three inches above grass	41	295·1	7·1	...	.....	...	41	295·1	7·2
	Six inches above grass	6	18·7	3·2	...	.....	...	6	18·7	3·1
	On white raw wool	14	122·6	8·8	35	299·7	8·6	49	422·3	3·6
	On fine flax	9	82·6	9·2	54	482·2	8·9	63	564·8	9 0
	On coarse flax	12	100·2	8·3	...	.....	...	12	100·2	8·4
	On white unwrought cotton wool	7	57·2	8·2	...	.....	...	7	57·2	8·2
	On lead	...	.....	...	11	61·1	5·5	11	61·1	5·6
	On blackened tin	5	29·6	5·9	13	97·8	7·5	18	127·4	7·1
	On white tin	5	24·3	4·9	13	91·9	7·1	18	116·2	6·4
	In focus of metallic reflector	78	591·1	7·6	55	374·4	6·8	133	965·5	7·3
Cloudless.	On long grass exposed to $\frac{1}{4}$ths of the sky	22	143·6	6·5	...	.....	...	22	143·6	6·5
	On long grass fully exposed to the sky	21	203·0	9·7	100	920·2	9·2	121	1123·2	9·3
	On short grass	47	322·1	6·9	98	866·1	8·9	145	1188·2	8·2
	On garden mould	13	73·8	5·7	...	.....	...	13	73·8	5·7
	One inch above grass	38	341·2	5·7	...	.....	...	38	341·2	9·0
	Three inches above grass	29	214·0	7·4	...	.....	...	29	214·0	7·4
	Six inches above grass	1	5·2	5·2	...	.....	...	1	5·2	5·2
	On white raw wool	13	153·5	11·8	60	726·2	12·1	73	879·7	12·1
	On fine flax	17	146·6	8·6	91	1123·6	12·3	108	1270·2	11·8
	On coarse flax	12	131·7	11·0	...	.....	...	12	131·7	10·9
	On white unwrought cotton wool	11	113·1	10·3	...	.....	...	11	113·1	10·3
	On lead	...	.....	...	29	245·8	8·5	29	245·8	8·5
	On blackened tin	...	.....	...	5	40·1	8·0	5	40·1	8·0
	On white tin	...	.....	...	5	39·8	8·0	5	39·8	7·9
	In focus of metallic reflector	81	768·1	9·5	99	770·1	7·8	180	1538·2	8·5

An examination of this Table shows, that on cloudy nights the results derived from every substance, with the single exception of garden mould, are nearly the same; and on partially cloudy nights they are different; the greatest differences occurring on cloudless nights. The reading of the thermometer on garden mould was always the nearest to the reading of the thermometer in the air; those on raw wool and on flax departed the most from it; and those placed, at the distance of one inch to two inches above the top of grass, on a sheet of lead or tin, were all higher than that on garden mould and less than that on wool; and they were all nearly identical with that of the thermometer in the reflector, notwithstanding much heat during the course of a whole night must have passed from the earth to the surface of the lead and tin, which were placed on it.

In this respect the results are somewhat different from those obtained from simultaneous observations of mercurial thermometers; but it would certainly seem that a thermometer placed on a sheet of metal on the ground will read as low as that in the reflector, although that of the latter would attain its lowest reading in less time than that of the former.

From the numbers in this table the numbers in the first ten columns of Table CVI. are formed.

As in a previous part of this paper it has been stated that on cloudy nights a thermometer read differently according as the cloud was high or low, the following Table has been formed by collecting all those cases in which the night has been cloudy throughout.

TABLE CIII.—Showing the results on totally cloudy nights, but the clouds *not* cirrostratus.

The sky covered with cloud during the night, the cloud other than cirrostratus.											
		The excess of the reading of a self-registering minimum therm. placed in air at the height of 4 feet and protected from radiation, above that of a similar thermometer fully exposed to the sky, placed									
Year.	Month, day and hour of reading the instruments.	On long grass.	On short grass.	On white raw wool.	On fine flax.	On coarse flax.	On white unwrought cotton wool.	On blackened tin.	On white tin.	In focus of metallic parabolic reflector.	
	d h	°	°	°	°	°	°	°	°	°	°
1842.	Nov. 7 21	.....	.....	.....	.....	.....	.....	.....	.....	9·3	.....
	9 21	.....	.....	.....	.....	.....	.....	.....	.....	9·0	.....
	17 21	.....	.....	.....	.....	.....	.....	.....	.....	9·4	.....
	20 21	.....	.....	.....	.....	.....	.....	.....	.....	8·7	.....
1843.	Feb. 14 21	.....	.....	.....	.....	.....	.....	.....	.....	13·3	.....
	25 21	.....	.....	.....	.....	.....	.....	.....	.....	8·5	.....
	Nov. 10 21	9·7	7·6	12·6	12·3	13·4	12·2	.....	.....	9·5	32·6
1844.	Feb. 14 21	8·5	7·6	14·8	13·8	.....	.....	7·3	6·8	7·5	36·8
	May 9 21	10·7	9·9	9·3	9·4	.....	.....	.....	.....	11·4	51·7
	Oct. 10 21	10·0	6·4	.....	11·5	.....	.....	.....	.....	7·9	44·5

Table CIV. has been formed by collecting all those cases in which the night has been cloudy throughout, and the clouds have been noted as being high; and Table CV. has been formed in a similar way from all those marked low. Those cloudy nights during which the height of the cloud was not noted have not been used. The means of the results in Tables CIII., CIV. and CV. are contained in Table CVI.

TABLE CIV.—Showing the results, at times with a totally cloudy sky, the clouds being cirrostratus from 3000 to 4000 feet high.

Year.	Month, day and hour of reading the instruments.	The sky covered with a high cirrostratus cloud during the night previous to reading the instruments. The excess of the reading of a self-registering minimum thermometer, placed in air at the height of 4 feet and protected from radiation, above that of a similar thermometer fully exposed to the sky, placed														Minimum reading of a therm. at the height of 4 feet protected from radiation.
		On long grass exposed to 5ths of the sky.	On long grass.	On short grass.	On garden mould.	In air one inch high.	In air three inches high.	In air six inches high.	On white raw wool.	On fine flax.	On coarse flax.	On white unwrought cotton wool.	On lead.	On blackened tin.	On white tin.	In focus of metallic parabolic reflector.	
	d h	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
1843.	April 28. 21	4·0	.....	5·6	2·3	4·8	3·0	.....	.....	.....	.....	.....	.....	.....	.....	6·6	41·8
	29. 21	7·3	.....	8·1	6·2	6·0	7·3	.....	.....	.....	.....	.....	.....	.....	.....	7·3	46·0
	May 12. 21	7·5	.....	5·5	6·0	3·3	7·6	.....	.....	.....	.....	.....	.....	.....	.....	2·1	51·3
	13. 21	3·0	.....	4·5	−0·5	4·5	3·5	.....	.....	.....	.....	.....	.....	.....	.....	3·8	45·0
	15. 21	5·4	.....	2·1	2·4	3·4	3·2	.....	.....	.....	.....	.....	.....	.....	.....	3·7	49·4
	16. 21	9·3	.....	6·3	.....	7·3	10·3	.....	.....	.....	.....	.....	.....	.....	.....	5·0	49·3
	23. 21	4·6	.....	6·1	5·8	8·9	9·0	.....	.....	.....	.....	.....	.....	.....	.....	2·8	52·6
	June 14. 21	4·5	.....	5·9	3·6	6·8	7·1	.....	.....	.....	.....	.....	.....	.....	.....	6·4	57·0
	July 18. 21	3·8	.....	9·8	.....	9·6	5·1	.....	.....	.....	.....	.....	.....	.....	.....	7·3	52·3
	20. 21	4·0	.....	4·0	.....	4·0	4·1	.....	.....	.....	.....	.....	.....	.....	.....	5·1	54·1
	September 3. 21	5·7	.....	3·7	.....	4·2	4·6	.....	.....	.....	.....	.....	.....	.....	.....	7·2	57·2
	8. 21	4·8	.....	5·4	.....	5·3	5·6	.....	.....	.....	.....	.....	.....	.....	.....	8·6	61·6
	October 11. 21	.....	7·3	5·0	.....	3·8	.....	2·3	.....	.....	.....	.....	.....	.....	.....	6·4	49·3
	November 5. 21	.....	6·3	4·0	.....	3·5	.....	.....	7·7	6·5	8·5	4·7	.....	.....	.....	3·7	40·7
	Decemb. 13. 21	.....	6·8	7·8	.....	.....	.....	.....	8·3	.....	7·1	.....	.....	6·5	5·3	2·3	39·3
	16. 21	.....	7·5	5·9	.....	.....	.....	.....	5·6	.....	5·9	.....	.....	.....	3·2	5·7	44·7
	20. 21	.....	3·9	2·4	.....	.....	.....	.....	1·9	.....	2·2	.....	.....	1·9	1·9	3·2	41·4
	23. 21	.....	5·6	4·8	.....	.....	.....	.....	4·2	.....	5·0	.....	.....	4·0	3·8	4·5	49·8
	29. 21	.....	3·2	3·2	.....	.....	.....	.....	3·3	.....	3·5	.....	.....	2·5	2·6	5·2	38·5
	30. 21	.....	2·1	2·5	.....	.....	.....	.....	2·1	.....	2·8	.....	.....	2·1	2·5	3·7	39·3
1844.	January 8. 21																
	17. 21	.....	4·5	4·2	.....	.....	.....	.....	3·9	3·3	.....	.....	.....	4·5	1·7	0·5	38·5
	23. 21	.....	4·6	4·2	.....	.....	.....	.....	5·9	4·6	.....	.....	.....	4·9	3·9	2·4	36·2
	February 11. 21	.....	6·0	4·1	.....	.....	.....	.....	7·2	4·1	.....	.....	.....	5·2	4·7	4·7	39·1
	March 4. 21	.....	5·9	4·2	.....	.....	.....	.....	5·6	5·2	.....	.....	5·3	.....	.....	5·9	32·4
	8. 21	.....	4·6	3·0	.....	.....	.....	.....	3·8	3·1	.....	3·0	.....	.....	.....	3·5	36·2
	16. 21	.....	8·1	7·7	.....	.....	.....	.....	9·1	9·1	.....	.....	6·3	.....	.....	4·1	46·1
	April 13. 21	.....	4·9	5·1	.....	.....	.....	.....	7·7	8·4	.....	.....	5·3	.....	.....	3·1	48·7
	August 24. 21	.....	7·6	5·8	.....	.....	.....	.....	8·5	7·3	.....	.....	.....	.....	.....	6·5	52·3
	25. 21	.....	4·4	3·2	.....	.....	.....	.....	.....	5·3	.....	.....	.....	.....	.....	9·1	52·4
	Septemb. 14. 21	.....	4·8	4·4	.....	.....	.....	.....	.....	4·9	.....	.....	.....	.....	.....	6·0	57·3
	15. 21	.....	4·1	4·6	.....	.....	.....	.....	.....	4·8	.....	.....	.....	.....	.....	5·9	61·4
	October 1. 21	.....	5·1	4·6	.....	.....	.....	.....	.....	5·6	.....	.....	.....	.....	.....	3·2	57·6
	12. 21	.....	5·7	6·0	.....	.....	.....	.....	.....	9·8	.....	.....	.....	.....	.....	3·6	55·6
	20. 21	.....	10·0	6·4	.....	.....	.....	.....	.....	11·5	.....	.....	.....	.....	.....	7·9	44·5
	23. 21	.....	7·7	9·7	.....	.....	.....	.....	.....	13·3	.....	.....	.....	.....	.....	5·0	35·5
	25. 21	.....	9·1	5·5	.....	.....	.....	.....	.....	16·1	.....	.....	.....	.....	.....	7·9	43·1
	November 5. 21	.....	5·1	2·6	.....	.....	.....	.....	.....	4·1	.....	.....	.....	.....	.....	2·2	39·1
	14. 21	.....	5·2	5·2	.....	.....	.....	.....	.....	1·8	.....	.....	.....	.....	.....	2·8	47·6
	Decemb. 15. 21	.....	5·1	3·6	.....	.....	.....	.....	.....	4·6	.....	.....	.....	.....	.....	4·8	35·4
	22. 21	.....	4·9	2·9	.....	.....	.....	.....	.....	4·1	.....	.....	.....	.....	.....	5·9	29·1
	30. 21	.....	5·8	3·4	.....	.....	.....	.....	.....	2·5	.....	.....	.....	.....	.....	5·9	34·1
	31. 21	.....	4·9	2·7	.....	.....	.....	.....	.....	2·9	.....	.....	.....	.....	.....	3·9	35·1

TABLE CV.—Showing the results with a totally cloudy sky, the clouds being cirrostratus and less than 2000 feet high.

The sky covered with a low cirrostratus cloud during the night previous to reading the instruments.																	
Year.	Month, day and hour of reading the instruments.	The excess of the reading of a self-registering minimum thermometer, placed in air at the height of 4 feet and protected from radiation, above that of a similar thermometer fully exposed to the sky, placed															Minimum reading of a thermometer at 4 feet high protected from radiation.
		On long grass exposed to $\frac{3}{4}$ths of the sky.	On long grass.	On short grass.	On garden mould.	In air one inch high.	In air three inches high.	In air six inches high.	On white raw wool.	On fine flax.	On coarse flax.	On white unwrought cotton wool.	On lead.	On blackened tin.	On white tin.	In focus of metallic parabolic reflector.	
	d h	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1843.	May 5 21	2·4	.....	0·9	1·4	2·7	2·7	.....	.....	.....	.....	.....	.....	.....	.....	2·0	50·2
	17 21	2·0	.....	0·0	1·8	4·0	4·0	.....	.....	.....	.....	.....	.....	.....	.....	4·5	44·0
	18 21	1·7	.....	−0·9	0·7	1·5	2·9	.....	.....	.....	.....	.....	.....	.....	.....	3·8	44·8
	30 21	3·3	.....	1·9	2·2	3·0	3·1	.....	.....	.....	.....	.....	.....	.....	.....	2·8	50·3
	June 7 21	2·1	.....	1·1	1·2	3·9	1·8	.....	.....	.....	.....	.....	.....	.....	.....	1·4	49·9
	12 21	...	.....	.....	.....	0·8	.....	.....	.....	.....	.....	.....	.....	.....	.....	2·2	48·8
	17 21	0·6	.....	1·6	−1·9	3·0	2·1	.....	.....	.....	.....	.....	.....	.....	.....	2·0	50·6
	July 12 21	1·3	.....	1·1	.....	1·1	0·9	.....	.....	.....	.....	.....	.....	.....	.....	1·8	55·3
	28 21	0·2	.....	0·2	.....	−0·1	−0·2	.....	.....	.....	.....	.....	.....	.....	.....	1·1	53·1
	Aug. 23 21	0·7	.....	1·3	.....	1·4	1·2	.....	.....	.....	.....	.....	.....	.....	.....	3·9	53·9
	29 21	2·3	.....	1·2	.....	1·7	2·2	.....	.....	.....	.....	.....	.....	.....	.....	3·8	61·0
	Oct. 8 21	.....	0·7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0·9	48·5
	10 21	.....	3·3	0·9	.....	0·9	.....	.....	.....	.....	.....	.....	.....	.....	.....	0·7	46·9
	20 21	.....	6·9	0·6	.....	−0·5	.....	1·7	6·3	5·8	5·9	2·8	.....	.....	.....	3·8	38·3
	30 21	.....	0·3	1·8	.....	1·6	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·6	51·1
	31 21	.....	.....	0·2	.....	0·0	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·0	42·5
	Nov. 2 21	.....	−1·3	−0·3	.....	0·3	.....	.....	0·6	0·2	−0·1	−0·1	.....	.....	.....	−0·1	41·2
	15 21	.....	1·6	0·3	.....	.....	.....	.....	3·4	−0·4	0·2	1·3	.....	.....	.....	1·8	31·6
	17 21	.....	2·5	2·7	.....	.....	.....	.....	3·5	3·7	3·1	2·5	.....	.....	.....	2·7	37·7
	21 21	.....	4·1	4·3	.....	.....	.....	.....	4·6	.....	.....	.....	.....	.....	.....	3·6	52·6
	22 21	.....	2·4	2·1	.....	.....	.....	.....	3·5	.....	.....	.....	.....	.....	.....	2·8	44·6
	25 21	.....	−0·3	−4·1	.....	.....	.....	.....	−0·1	−0·1	.....	.....	.....	.....	.....	0·1	45·9
	30 21	.....	1·6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·2	45·7
	Dec. 3 21	.....	2·3	2·3	.....	.....	.....	.....	2·1	.....	2·0	.....	.....	.....	.....	3·3	45·3
	4 21	.....	1·9	2·2	.....	.....	.....	.....	1·7	.....	1·5	.....	.....	2·1	2·2	2·8	45·5
	9 21	.....	2·5	−1·9	.....	.....	.....	.....	0·6	.....	1·1	.....	.....	0·8	1·1	2·6	35·1
	11 21	.....	1·1	1·4	.....	.....	.....	.....	0·3	.....	2·2	.....	.....	0·4	0·2	2·9	30·4
	12 21	.....	3·8	3·4	.....	.....	.....	.....	2·8	.....	5·3	.....	.....	1·6	4·3	2·8	25·6
	18 21	.....	2·5	3·2	.....	.....	.....	.....	2·4	.....	3·1	.....	.....	2·5	2·7	3·7	42·5
	19 21	.....	0·6	0·0	.....	.....	.....	.....	1·1	.....	2·0	.....	.....	1·3	2·3	2·6	42·3
	21 21	.....	2·9	2·7	.....	.....	.....	.....	2·2	.....	2·3	.....	.....	1·8	2·1	3·9	41·9
	22 21	.....	0·5	1·2	.....	.....	.....	.....	−0·3	.....	0·9	.....	.....	0·3	0·9	2·3	42·5
	26 21	.....	1·5	2·5	.....	.....	.....	.....	0·9	.....	1·5	.....	.....	1·5	1·9	2·7	42·5
	28 21	.....	1·8	2·0	.....	.....	.....	.....	1·9	.....	1·6	.....	.....	1·2	1·4	2·3	42·5

Table (Continued).

The sky covered with a low cirrostratus cloud during the night previous to reading the instruments.																		
Year.	Month, day and hour of reading the instruments.	The excess of the reading of a self-registering minimum thermometer, placed in air at the height of 4 feet and protected from the effects of radiation, above that of a similar thermometer fully exposed to the sky, placed																Minimum reading of a thermometer at 4 feet high protected from radiation.
		On long grass exposed to $\frac{3}{4}$ths of the sky.	On long grass.	On short grass.	On garden mould.	In air one inch high.	In air three inches high.	In air six inches high.	On white raw wool.	On fine flax.	On coarse flax.	On white unwrought cotton wool.	On lead.	On blackened tin.	On white tin.	In focus of metallic parabolic reflector.	
	d h	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1844.	Jan. 9 21	.....	1·7	0·9	.....	.....	.....	.....	1·7	0·2	.....	.....	.....	0·9	0·5	0·2	30·7
	12 21	.....	1·8	1·7	.....	.....	.....	.....	2·4	1·2	.....	.....	.....	2·4	1·9	−0·8	39·2
	13 21	.....	1·6	0·9	.....	.....	.....	.....	1·5	0·7	.....	.....	.....	1·7	1·2	−1·8	32·7
	Feb. 21 21	.....	0·3	0·5	.....	.....	.....	.....	1·4	−0·2	.....	.....	0·4	.....	.....	−1·5	32·0
	Mar. 14 21	.....	0·5	1·1	.....	.....	.....	.....	0·7	2·8	.....	.....	1·7	.....	.....	−0·2	38·1
	22 21	.....	1·3	1·1	.....	.....	.....	.....	1·5	2·5	.....	.....	1·1	.....	.....	−1·2	39·8
	31 21	.....	0·6	0·2	.....	.....	.....	.....	2·0	0·2	.....	.....	−0·2	.....	.....	0·7	37·3
	April 26 21	.....	0·6	0·1	.....	.....	.....	.....	2·0	1·3	.....	.....	0·4	.....	.....	1·1	46·1
	May 22 21	.....	0·2	0·0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0·4	47·4
	Sept. 9 21	.....	0·8	1·1	.....	.....	.....	.....	.....	0·8	.....	.....	.....	.....	.....	5·8	55·8
	Oct. 15 21	.....	2·0	1·7	.....	.....	.....	.....	.....	2·2	.....	.....	.....	.....	.....	2·9	46·7
	24 21	.....	1·1	0·5	.....	.....	.....	.....	.....	1·9	.....	.....	.....	.....	.....	2·7	47·2
	29 21	.....	3·7	2·4	.....	.....	.....	.....	.....	2·7	.....	.....	.....	.....	.....	7·7	42·7
	Nov. 12 21	.....	0·8	0·9	.....	.....	.....	.....	.....	−0·1	.....	.....	.....	.....	.....	1·8	48·8
	17 21	.....	0·8	0·6	.....	.....	.....	.....	.....	0·6	.....	.....	.....	.....	.....	2·7	48·7
	Dec. 1 21	.....	1·9	0·8	.....	.....	.....	.....	.....	2·1	.....	.....	.....	.....	.....	3·9	34·1
	2 21	.....	3·0	0·4	.....	.....	.....	.....	.....	2·3	.....	.....	.....	.....	.....	5·1	32·3
	3 21	.....	2·2	1·1	.....	.....	.....	.....	.....	1·6	.....	.....	.....	.....	.....	3·6	34·1
	8 21	.....	2·3	2·8	.....	.....	.....	.....	.....	−0·4	.....	.....	.....	.....	.....	3·9	25·1
	9 21	.....	1·7	0·3	.....	.....	.....	.....	.....	8·5	.....	.....	.....	.....	.....	3·3	27·8
	10 21	.....	1·2	−0·2	.....	.....	.....	.....	.....	2·7	.....	.....	.....	.....	.....	3·0	27·7
	12 21	.....	0·7	−0·8	.....	.....	.....	.....	.....	0·4	.....	.....	.....	.....	.....	2·9	23·2
	13 21	.....	0·3	−0·9	.....	.....	.....	.....	.....	2·9	.....	.....	.....	.....	.....	2·2	24·4
	14 21	.....	2·8	1·4	.....	.....	.....	.....	.....	2·3	.....	.....	.....	.....	.....	2·7	28·1
	16 21	.....	1·1	0·4	.....	.....	.....	.....	.....	0·3	.....	.....	.....	.....	.....	2·9	37·1
	17 21	.....	2·0	1·1	.....	.....	.....	.....	.....	1·1	.....	.....	.....	.....	.....	3·1	38·1
	18 21	.....	0·8	0·3	.....	.....	.....	.....	.....	0·3	.....	.....	.....	.....	.....	2·3	46·3
	23 21	.....	2·4	0·7	.....	.....	.....	.....	.....	1·5	.....	.....	.....	.....	.....	4·0	29·5
	24 21	.....	2·3	1·8	.....	.....	.....	.....	.....	2·3	.....	.....	.....	.....	.....	2·3	31·3
	25 21	.....	1·8	0·8	.....	.....	.....	.....	.....	1·3	.....	.....	.....	.....	.....	3·4	31·1
	27 21	.....	3·6	0·9	.....	.....	.....	.....	.....	3·8	.....	.....	.....	.....	.....	2·6	29·8
	28 21	.....	1·7	1·0	.....	.....	.....	.....	.....	1·3	.....	.....	.....	.....	.....	3·2	40·5
	29 21	.....	0·5	−1·1	.....	.....	.....	.....	.....	−0·5	.....	.....	.....	.....	.....	2·2	37·5

TABLE CVI.—The sum of the excesses, and the mean excess of a self-registering minimum thermometer placed in Air at the height of four feet above the soil and protected from the effects of radiation, above those of similar thermometers placed on different substances, or in different situations, fully exposed to the sky.

Situation of the thermometer.	The sum of the excess of the readings of the thermometer in air above the readings of other thermometers placed as stated.										The mean excess.				Sum and mean excess, at times when								
	General state of the sky.										Mean state of the sky.				The sky was covered with cirrostratus cloud during the night whose							Sky was covered with cloud all night, but not of the cirro-stratus character.	
	Cloudy.		Principally cloudy.		Half-cloudy.		Principally clear.		Cloudless.						Height was from 3000 to 4000 feet.			Whose height was from 1000 to 3000 feet.			Difference corresponding to a difference of height of about 2000 feet.		
	Number of nights.	Sum of excesses.	Number of nights.	Sum of excesses.	Number of nights.	Sum of excesses.	Number of nights.	Sum of excesses.	Number of nights.	Sum of excesses.	Whole number of nights.	Whole sum of excesses.	Mean excess.	Relative excess, that of long grass being =1000.	Number of nights.	Sum of excesses.	Mean excess.	Number of nights.	Sum of excesses.	Mean excess.		Number of nights.	Mean excess.
		°		°		°		°		°		°	°			°	°		°	°	°		°
On long grass exposed to $\frac{1}{4}$ths of the sky	29	93·6	25	101·2	22	88·6	37	178·5	22	143·6	135	607·5	4·50	715	12	63·9	5·3	10	16·6	1·7	3·6		
On long grass fully exposed	129	446·1	63	431·6	77	559·1	77	374·4	121	1123·2	467	2934·4	6·29	1000	30	170·8	5·7	55	92·7	1·6	4·1	4	9·7
On short grass	156	441·1	89	485·1	99	620·9	116	838·4	145	1188·2	605	3573·7	5·91	939	42	205·7	4·9	64	64·5	1·0	3·9	4	7·9
On garden mould	29	40·2	16	59·7	10	39·7	17	55·6	13	73·8	85	269·0	3·17	500	7	25·8	3·7	6	5·4	0·9	2·8		
One inch above grass	34	103·0	28	146·0	34	202·5	52	368·3	38	341·2	186	1161·0	6·24	992	14	75·4	5·5	16	25·3	1·6	3·9		
Three inches above grass	31	111·5	29	149·0	28	168·9	41	295·1	29	214·0	158	938·5	5·94	944	12	70·4	5·9	10	20·7	2·1	3·8		
Six inches above grass	...	.....	...	.....	3	12·5	6	18·7	1	5·2	10	36·4	3·64	579	1	2·3	2·3	1	1·7	1·7	0·6		
On white raw wool	65	257·1	47	355·9	42	307·3	49	422·3	73	879·7	276	2222·3	8·05	1280	15	84·8	5·7	26	51·3	2·0	3·7	3	12·2
On fine flax	98	379·5	49	364·0	60	425·1	63	564·8	108	1270·2	378	3003·6	7·95	1264	23	152·9	7·1	37	59·8	1·6	5·5	4	11·8
On coarse flax	22	67·6	8	45·4	4	25·5	12	100·2	12	131·7	58	370·4	6·39	1016	7	35·0	5·0	15	32·6	2·2	2·8	1	13·4
On white unwrought cotton wool	5	11·2	1	6·5	4	17·6	7	57·2	11	113·1	28	205·6	7·34	1167	1	4·7	4·7	4	6·5	1·6	3·1	1	12·2
On lead	11	31·0	7	44·3	14	70·7	11	61·1	29	245·8	72	452·9	6·29	1000	4	19·9	5·0	5	3·4	0·7	4·3		
On blackened tin	29	96·2	20	111·9	12	70·4	18	127·4	5	40·1	84	446·0	5·31	844	8	31·6	4·0	13	18·5	1·4	2·6	1	7·3
On white tin	40	89·1	19	95·9	12	59·8	18	116·2	5	39·8	94	400·8	4·26	677	9	29·6	3·3	13	22·7	1·7	1·6	1	6·8
In focus of reflector	183	604·3	98	495·6	122	731·3	133	965·5	180	1538·2	716	4334·9	6·05	962	42	205·4	4·9	67	158·3	2·4	2·5	10	9·4

The numbers in the column of mean excess exhibit the mean difference between the reading of a self-registering minimum thermometer placed in air, at the height of four feet, and protected as much as possible from the effects of radiation, and the readings of similar thermometers placed as stated in the first column. The first results are those relating to grass; that deduced from grass exposed to three-fourths of the sky, is about three-fourths of that deduced from grass exposed to the whole of the sky; and that from long grass is larger than that from short grass. Of all the substances upon which experiments have been made with spirit thermometers, those on which the lowest readings have occurred were the filamentous, viz. wool and flax, and they were nearly alike.

The next class of bodies consisted of metals; of these lead exhibited the lowest readings in the mean; but this must have arisen from the circumstance of its having been generally used on the clearest nights only, during which there was found to be a very small difference between its readings and that of the thermometer in the reflector; in fact in all simultaneous observations it was found that the readings of the latter thermometer had no advantage over the readings of one placed on lead.

The thermometers which were placed within a few inches of the top of grass exhibited higher readings than those of the last class, and those which were from one to three inches from the top of grass, generally read the same as that in the reflector.

The reading which most nearly agreed with that in air was on garden mould, which was about a mean between that on long grass and that in the air; these observations were made on ground undisturbed; the readings would have been still nearer those in the air, had the ground been frequently disturbed so as to have been loose, as it was found in this state to admit the heat to pass more readily from beneath to the surface.

The numbers in the next column represent the relative radiating power of the several substances deduced by considering the mean result from long grass to be represented by 1000.

The following columns of the table represent the mean results for each substance on nights wholly cloudy, but the clouds of different heights. This result is very important, as it shows that the amount of radiation may be large on a wholly cloudy night, providing that the clouds be high. The differences between the results on a cloudy night when the clouds are high and when they are low, are very great; the numbers in the Table exhibit the mean difference between the results deduced when the clouds have been high, and when moderately low.

The last column shows that on a cloudy night, providing the kind of cloud be other than cirrostratus, the amount of radiation may nearly equal that on a cloudless night.

At a very early stage in the investigation it was found that the variation in the height of the clouds had a very considerable effect on the reading of a thermometer placed on any substance fully exposed to the sky, during those nights that the sky was wholly covered with an apparent uniform cirrostratus cloud.

At the Royal Observatory at Greenwich, the reflexion of the lights of London on the clouds is well seen; at times this appears as a narrow well-defined band of light, at the elevation of several degrees, and at other times as a broad diffused band; the lower limit of which is sometimes below the horizon. It was soon found that the difference between the reading of the thermometer in air and that on grass was greater, the greater the height of this band of light. On very many nights, and several times in the course of the same night, the height of the upper and lower edges of this band of reflected light was measured above the horizon, and from these observations that of the centre was determined; at the same times the readings of the thermometers in air and on grass were taken. By these means it was found that when the centre of the reflected light was above the horizon of Greenwich by—

4°, the excess of reading of the thermometer in air above that on grass was 1°·6
6°, the excess of reading of the thermometer in air above that on grass was 2°·5
8°, the excess of reading of the thermometer in air above that on grass was 3°·9

And whenever the centre of the band was in height less than 4°, the lower limit was generally below the horizon, and the height of the centre could not be determined; but at these times the differences between the readings of the two thermometers was seldom so much as a degree, and it was generally less, and frequently there was no difference.

The Cathedral of St. Paul is very nearly the centre of London, and it may be considered to be immediately under the centre of the reflected light; its distance from the Magnetic House is more than 25,700 feet; at this distance one degree subtends about 450 feet; the height of the ground where the observations were taken is about 100 feet higher than the ground at London.

From the above data, it appears that when the reflexion of the London lights was 4°, 6°, and 8° high, the distances of the clouds from the earth was 1900, 2800, and 3700 feet respectively.

A similar investigation was made by measuring the distance of the band from the cross on the cathedral, whose height above the ground is about 400 feet, and results were obtained differing from the preceding by about fifty feet; a much smaller number of observations, however, were used in deducing the latter results than were used in deducing the former.

As a difference of 0°·7 took place in the reading of a thermometer on grass for every variation of a degree in the height of the reflected lights, it follows that a difference of 1° in the readings of the thermometer on the grass indicated a difference of 630 feet in the height of the cloud.

TABLE CVII.—Showing the monthly mean temperature, and state of cloudiness of the nights, also the greatest differences and the lowest thermometrical readings each month.

Year.	Month.	Mean temperature of the month by a thermometer in air at 4 feet high, protected from radiation.	Mean reading of all the minimum readings, in the month, of the thermometer in air.	Excess of the mean reading of the minimum thermometer in air at 4 feet high, above that of a similar thermometer placed in the focus of a reflector.	Mean state of the sky with respect to the quantity of cloud during the night, 10 being quite cloudy, and 0 being quite clear.	Mean yearly excess of the reading of thermometer in air, above that in reflector.	The greatest excess, in each month, of the minimum reading of a self-registering thermometer, placed in air 4 feet above the ground and protected from radiation, above the minimum reading of a similar thermometer fully exposed to the sky, placed						The lowest reading in each month of the self-registering thermometer placed						
							In focus of metallic parabolic reflector.	On long grass	On short grass.	On white raw wool.	On flax.	On lead.	On tin.	In air at 4 feet high.	In focus of metallic parabolic reflector.	On long grass.	On short grass.	On white raw wool.	On flax.	On lead.	On tin
		°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1841.	February	38·3	31·6	0·7	9·0	...	5·8	...	...	...	...	...	...	18·8	14·0						
	March	46·2	38·7	5·3	4·7	...	13·4	...	...	...	...	...	...	29·5	26·3						
	April	47·0	39·9	5·0	6·3	...	11·6	...	...	...	...	...	...	31·2	24·4						
	May	56·8	48·4	3·8	4·9	...	8·5	...	...	...	...	...	...	41·2	33·4						
	June	56·4	48·2	4·5	5·5	...	11·2	...	...	...	...	...	...	40·3	32·0						
	July	57·8	51·5	3·5	6·8	4·0	10·9	...	...	...	...	...	...	44·3	39·0						
	August	60·5	54·3	2·9	6·5	...	14·0	...	...	...	...	...	...	45·5	39·0						
	September	58·1	51·2	4·2	5·2	...	11·7	...	...	...	...	...	...	36·6	31·0						
	October	48·8	43·9	3·6	6·8	...	12·9	...	...	...	...	...	...	32·2	29·0						
	November	43·7	38·0	5·0	7·2	...	10·0	...	...	...	...	...	...	22·6	12·6						
	December	40·5	35·4	5·6	6·8	...	11·8	...	...	...	...	...	...	24·3	12·5						
1842.	January	32·9	29·3	5·3	7·8	...	12·0	...	...	...	...	...	...	23·2	12·5						
	February	40·8	36·0	4·9	7·5	...	9·3	...	...	...	...	...	...	26·4	21·4						
	March	44·9	39·2	4·5	6·9	...	8·2	...	...	...	...	...	...	29·9	23·2						
	April	45·2	37·3	5·1	4·6	...	9·3	...	...	...	...	...	...	28·0	20·5						
	May	53·2	45·0	5·0	5·2	...	9·5	...	...	...	...	...	...	36·4	30·5						
	June	62·9	52·2	7·1	4·6	...	16·0	...	...	...	...	...	...	44·7	35·0						
	July	60·2	52·1	5·8	6·3	5·3	10·4	...	...	...	...	...	...	45·5	37·5						
	August	65·4	56·3	5·1	6·5	...	8·3	...	...	...	...	...	...	47·5	41·7						
	September	56·4	49·8	3·3	6·0	...	8·0	...	...	...	...	...	...	41·1	36·5						
	October	45·4	39·3	6·2	5·8	...	14·2	...	...	...	...	...	...	28·3	17·2						
	November	42·8	39·0	6·8	7·4	...	11·9	...	...	...	...	...	...	31·1	20·6						
	December	45·0	40·2	4·6	7·3	...	9·4	...	...	...	...	...	...	30·8	24·7						
1843.	January	39·9	35·4	7·1	7·0	...	11·7	...	...	...	...	...	...	24·0	12·3						
	February	36·0	31·9	6·5	7·9	...	14·1	...	...	...	...	...	...	20·3	7·0						
	March	42·9	37·5	8·2	5·8	...	17·6	...	...	...	...	...	...	29·0	11·4						
	April	47·1	40·7	6·9	5·9	...	13·0	...	11·2	...	...	...	...	27·2	17·8						
	May	52·2	45·5	5·1	6·9	...	10·5	...	11·9	...	...	...	...	35·4	28·0	...	28·0				
	June	56·3	49·0	6·8	6·9	...	13·0	...	11·7	...	...	...	...	42·6	33·2	...	31·8				
	July	60·9	53·5	6·2	7·1	6·5	11·3	...	13·6	...	...	...	...	44·6	35·2	...	36·0				
	August	62·1	55·2	7·6	5·4	...	11·8	...	13·7	...	...	...	...	47·2	37·8	...	35·0				
	September	59·5	52·3	7·9	4·5	...	13·0	13·8	13·3	...	...	...	...	36·0	27·6	25·8	27·9				
	October	48·0	42·0	5·5	6·0	...	11·0	11·2	9·0	14·0	17·3	...	...	28·5	17·5	18·5	19·5	14·5	11·2		
	November	43·8	38·7	5·7	5·8	...	10·1	11·5	8·4	16·1	15·4	...	...	27·4	19·2	15·9	19·0	13·5	13·2		
	December	43·9	40·3	4·5	8·8	...	7·2	10·2	9·5	10·0	10·2	...	9·2	25·6	22·8	21·8	22·2	22·8	20·3	...	21·0
1844.	January	39·1	34·6	3·2	6·0	...	8·3	10·2	9·9	13·7	10·6	...	9·6	18·6	9·8	...	...	...	9·2		
	February	35·2	31·3	4·3	5·0	...	7·6	11·6	8·8	10·2	12·0	...	10·9	20·0	13·5	12·8	15·7	7·8	9·0	...	15·5
	March	41·5	35·7	4·2	5·5	...	12·1	11·4	8·4	18·9	18·1	8·6	...	24·1	12·0	15·2	16·2	9·2	9·6	15·6	
	April	51·7	41·8	6·8	2·3	...	12·4	14·9	13·6	20·4	19·9	16·4	...	33·4	22·7	22·1	21·6	16·5	18·0	25·5	
	May	52·9	44·4	5·9	4·4	5·4	8·4	13·2	12·2	16·8	14·5	9·3	...	33·9	27·0	26·5	27·8	20·0	22·2		
	June	58·4	50·5	6·0	3·5	...	10·0	12·2	11·6	13·6	12·9	10·0	...	44·5	35·2	32·0	32·5	...			
	July	61·2	54·3	6·2	4·5	...	12·9	17·3	12·8	14·2	16·8	...	...	47·1	39·3	35·5	37·0	33·8	31·2		
	August	57·7	50·3	6·4	3·7	...	5·5	11·6	10·1	12·6	13·9	...	...	42·8	34·8	31·8	32·8	...	30·8		
	September	57·9	50·2	8·0	4·6	...	13·7	13·1	12·1	...	14·6	...	...	34·8	27·2	25·0	27·5	...	22·6		
	October	49·2	43·5	5·8	4·9	...	13·7	18·8	17·8	...	21·8	...	...	30·8	25·5	24·2	26·2	...	23·5		
	November	44·0	39·6	5·2	6·5	...	9·6	11·0	8·9	...	13·4	...	...	27·4	20·2	19·3	21·8	...	18·0		
	December	33·0	30·4	2·7	7·7	...	13·7	13·5	8·7	...	17·4	...	...	21·1	7·7	7·9	12·4	...	4·0		

The power of radiation, as exhibited in this Table, has evidently no tendency to increase with the heat, and in this respect does not serve even as an approximation to the law of radiation established by the experiments of MM. Dulong and Petit, viz. that the velocity of cooling *in vacuo* (or force of radiation) increases in the terms of a geometrical progression for excess of temperature in arithmetical progression; it is most probable that the effect is masked by too many disturbing causes to enable us from mere inspection to discover the law of its progression.

Table CVIII.—Monthly mean of the minimum temperature of the Air.

Year.	Month.	The monthly mean reading of the minimum self-registering thermometer placed in air at the height of 4 feet, according to the state of the sky.									
		State of the sky.									
		Cloudy.		Broken clouds.		Half-cloudy.		Principally clear.		Cloudless.	
		Number of nights.	Mean of the minimum temperatures.	Number of nights.	Mean of the minimum temperatures.	Number of nights.	Mean of the minimum temperatures.	Number of nights.	Mean of the minimum temperatures.	Number of nights.	Mean of the minimum temperatures.
1843.	April.	2	43·9	1	37·4	3	42·8	2	38·3	3	40·5
	May.	12	46·9	6	46·0	4	47·0	7	43·0	2	43·1
	June.	6	51·4	9	49·8	1	47·0	7	48·0	7	47·2
	July.	5	53·3	6	55·2	7	54·1	10	49·7	2	54·2
	August.	2	57·5	2	59·4	7	59·2	12	53·5	6	52·5
	September.	3	58·2	3	54·3	7	55·2	6	48·1	11	50·8
	October.	6	44·9	3	44·4	6	50·0	8	40·4	8	34·6
	November.	9	42·5	2	49·2	7	41·6	7	39·8	6	31·0
	December.	17	40·5	7	42·8	1	40·1	5	37·6	...	.....
1844.	January.	8	33·0	7	37·6	5	34·1	7	34·1	2	22·0
	February.	7	32·3	6	27·9	6	35·3	6	29·4	4	29·4
	March.	8	37·8	5	38·9	9	33·5	2	41·9	7	30·5
	April.	3	47·1	2	46·6	3	45·4	4	43·0	18	39·6
	May.	9	47·1	1	46·2	6	42·4	5	42·5	10	44·1
	June.	2	50·3	10	51·4	7	52·5	5	50·4	6	53·0
	July.	4	56·2	9	55·4	5	54·6	1	53·8	12	52·8
	August.	7	54·8	1	51·6	5	51·1	6	49·3	12	47·7
	September.	6	55·3	5	54·1	2	59·7	5	50·8	12	44·3
	October.	10	47·0	1	45·3	6	45·3	6	46·0	8	40·1
	November.	12	42·6	3	42·0	6	38·9	7	33·5	2	41·6
	December.	23	31·9	...	.....	...	.....	1	30·1	6	24·6

By taking the mean of these numbers according to the number of nights from which each result is deduced, we find that the mean of the lowest readings of the temperature of the air during

161 cloudy nights was	46°·2
89 broken cloudy nights was	46·9
103 half-cloudy nights was	46·0
119 principally clear nights was	43·9
144 cloudless nights was	42·4

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XII. *On the Cause of the Discrepancies observed by* Mr. Baily *with the Cavendish Apparatus for determining the mean density of the Earth.*

By George Whitehead Hearn, *Esq., of the Royal Military College, Sandhurst. Communicated by Sir* J. F. W. Herschel, *Bart., F.R.S.*

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In the Fourteenth Volume of the Transactions of the Royal Astronomical Society will be found a full account of the Cavendish apparatus, and of the mode of experimenting followed by Mr. Baily. It will therefore not be necessary for me, in this place, to enter into any detail as to the different parts of the instrument, and the various precautions adopted in order to avoid that singular source of error 'currents of air in the torsion box arising from unequal temperature,' which had been discovered by Cavendish. It will be sufficient for me to state that all the arrangements are of a highly satisfactory kind, and that I am of opinion that no aerial currents could have existed in the torsion box.

The deduction of the mean density of the earth from the observed vibrations of the balls influenced by the torsion force and the attraction of the masses, is founded on a mathematical theory of the motion of the balls given by the Astronomer Royal, Mr. Airy; and as this theory is certainly insufficient to account for the discrepancies, it will here be necessary to give a brief sketch of it.

The momentum of attraction of the masses and planks on the torsion rod and balls supposed to be in the zero position, is calculated. The weights or masses are all represented in grains, and one inch is taken as the unit of length. The momentum is called E. In deducing it, the portion depending on the attraction of the planks is obtained by supposing the masses of such planks to be collected in their axes. The moment of inertia is then found and called F. A modulus of attraction k is then assumed, so that $\frac{k \times E}{F}$ is the impressed angular accelerating force on the rod and balls in the zero position.

The distance from the centre of motion to the centre of the balls is denoted by c, so that, if θ be the very small arc described, $c\theta$ is the space described in inches.

Let $m^2\theta$ denote the force of torsion which is known to be proportional to the angle described, supposing the apparatus in a normal state; or if we suppose it slightly out of order so as to rest at an angle α from the zero position when the masses are removed, $m^2(\theta - \alpha)$ will denote the force of torsion; and it may also be conceived that the small force of attraction of the torsion box, &c. is included in this.

The equation for angular motion is then

$$\frac{d^2\theta}{dt^2}+m^2(\theta-\alpha)=\frac{k\times E}{F}(1+n\theta),$$

neglecting θ^2, &c., where n is a constant depending on the distance of the masses from the balls.

Making $m^2-\frac{k\times E}{F}n=\mu^2$, this equation may be written

$$\frac{d^2\theta}{dt^2}+\mu^2\theta=m^2\alpha+\frac{k\times E}{F}.$$

Multiply by i the distance from the centre of motion to the scale $=108$ inches, and put $i\theta=x$, $i\alpha=b$, then

$$\frac{d^2x}{dt^2}+\mu^2x=m^2b+\frac{k\times E\times i}{F},$$

in which the masses are in the positive position.

The integral of the equation is

$$x=\frac{m^2b}{\mu^2}+\frac{k\times E\times i}{F\mu^2}+A\cos(\mu t+B),$$

in which A and B are arbitrary constants depending on initial circumstances.

Let e be the value of x for the 'resting point,' or mean value of the above,

$$e=\frac{m^2b}{\mu^2}+\frac{k\times E\times i}{F\mu^2}.$$

When the masses are in the negative position, the only alteration in the equation (still measuring x the same way) is in the sign of k; we have, therefore, for the negative resting point,

$$e'=\frac{m^2b}{\mu^2}-\frac{k\times E\times i}{F\mu^2},$$

$$\therefore\quad \frac{e-e'}{2}=\frac{k\times E\times i}{F\mu^2}.$$

Also T being the time of vibration $T=\frac{\pi}{\mu}$.

Hence

$$\frac{1}{k}=\frac{2Ei}{F\pi^2}\frac{T^2}{e-e'}.$$

It is then shown, on the hypothesis that k is the same for all substances, and on the law of universal gravitation, that $k\Delta=H$, a constant depending on known quantities, so that we have

$$\Delta=H.\frac{2Ei}{F\pi^2}\frac{T^2}{e-e'}.$$

Every division of the scale is $\frac{1}{26}$th of an inch, so that if s and s' be the scale read-

ings for the resting points

$$s=26e \quad \text{and} \quad s'=26e',$$

$$\therefore \quad \Delta=\frac{T^2}{D}\times C,$$

where $$D=\frac{s-s'}{2} \text{ and } C=\frac{26HEi}{Fx^2}.$$

$\frac{26Hi}{x^2}$ is called the general constant, which, combined with $\frac{E}{F}$, gives C the *special* constant.

The resting points s and s' are not directly observed, and in strict accordance with the preceding theory, ought to be found thus.

Let σ and σ' be the scale readings at the extremities of the arc of vibration, or when $\mu t+B=0$ and π respectively,

$$\sigma=s+26A\cos 0=s+26A,$$
$$\sigma'=s+26A\cos\pi=s-26A;$$
$$\therefore \quad s=\frac{1}{2}(\sigma+\sigma').$$

We will now deduce a few values of Δ in strict accordance with the theory from the numerical values given by Mr. Baily, extracting the data furnished by observation from his tables.

1st Series.—2-inch lead balls with *bifilar silk* lines; distance ·177 inch.

1841.	No.	Position of masses.	Extreme divisions observed.	Time of vibration.	Mean of times.
				sec.	sec.
	13	Positive	50·00 177·50	501·782	501·434
	14	Negative.....	170·00 27·50	501·087	

Here $s=113{\cdot}9$, $s'=98{\cdot}75$; and $\therefore$ $D=\frac{s-s'}{2}=7{\cdot}575$.

$$\log C=6{\cdot}360356; \text{ and } \therefore \ \Delta=7{\cdot}6103.$$

Again,

22nd Series.—2½-inch hollow brass balls with *single copper* wire, diameter ·0219 in.

1841.	No.	Position of masses.	Extreme divisions observed.	Time of vibration.	Mean of times.
				sec.	sec.
	1084	Positive	86·20 118·74	216·111	216·1105
	1085	Negative.....	117·70 81·62	216·110	

Here $s=102{\cdot}47$, $s'=99{\cdot}66$; and $\therefore$ $D=\frac{s-s'}{2}=1{\cdot}405$.

$$\log C=6{\cdot}354454; \text{ and } \therefore \ \Delta=7{\cdot}5184.$$

It is to be observed that Mr. Airy's theory does not contemplate a difference in the *time* of vibration in different experiments with the same balls suspended in the same manner, and moreover the effect of resistance of the air is entirely omitted.

I have therefore selected the preceding consecutive positive and negative experiments which have the times very nearly alike.

The consideration of the resistance of the air might, however, at first sight, seem very necessary. Since the velocity is very small, we may, according to the conclusions of experimentalists, assume that the resistance varies nearly as the velocity; we ought therefore to introduce the term $\epsilon\frac{dx}{dt}$ into the differential equation. The result shows that the time of vibration is very little affected by the resistance, but the resting point very considerably. Mr. Baily observes four extreme divisions, that is, he watches the motion for three successive vibrations, and then takes the means of successive pairs of extreme divisions. In this way he has three first means. He then takes the means of successive pairs of those first means, and thus obtains two second means; and lastly, he takes the mean of the second means, and this third mean is considered the resting point or place where the torsion rod would be in equilibrium. This proceeding, as I afterwards shall prove, does in general pretty accurately correct for the resistance of the air, and therefore we may consider Baily's 'resting points' as those which would arise from Mr. Airy's theory, supposing the term $\epsilon\frac{dx}{dt}$ for resistance had been introduced into his investigation. After this Mr. Baily combines his experiments in a very remarkable manner. Three successive experiments are combined in order to produce what he terms a single result; and in combining them the means of the positive and negative resting points are taken, and *means* also of the *times* of vibration; for such times it is found are never all exactly alike, and sometimes differ considerably. In order that the reader may at once see the method pursued, I have made the following extract from the tables:—

3rd Series.—2-inch lead balls with *bifilar silk* lines; distance = ·177 inch; upper distance ·158 inch; lower dist. ·197 inch.

1841.	No.	Position of the masses.	Extreme divisions observed.	1st Mean.	2nd Mean.	3rd Mean or resting point.	Observed times.		2 N.		N for mean resting point.
Feb. 26. T = 44·500 B = 29·880	113	Negative.	126·90 54·80 119·00 56·90	90·850 86·900 87·950	88·875 87·425	88·150	h m s At div. 85 10 13 42·5 21 24 30 11	h m s At div. 90 10 13 20 21 48 29 45	m s By div. 85 16 28·5 8 14·25	m s By div. 90 16 25 8 13·50	s 493·148
	114	Positive.	56·90 155·40 63·80 152·00	106·150 109·600 107·900	107·875 108·750	108·312	At div. 105 10 38 35 47 24 55 26·5	At div. 110 10 38 51·5 47 6 55 45	By div. 105 16 51·5 8 25·75	By div. 110 16 53·5 8 26·75	506·412
	115	Negative.	152·00 30·60 146·80 36·00	91·300 88·700 91·400	90·000 90·050	90·025	At div. 85 11 4 33 12 24 21 20	At div. 90 11 4 19·5 12 38 21 5·5	By div. 85 16 47 8 23·5	By div. 90 16 46 8 23	502·998

3rd Series.—2-inch lead balls with *bifilar silk* lines; distance = ·177 inch.

1841.	No.	Pos.	Observed			Deduced.			Results.		
			Time of vibration.	Resting point.	Distance.	Time = N.	Deviation = D.	Distance = δ.	Single.	Daily.	
Feb. 26.	113	−	493·148	88·150	10·9936	502·242	9·612	10·9972	6·0199	5·6946	log. C = 6·360356.
	114	+	506·412	108·312	11·0008						
	115	−	502·998	90·025							

It is true that results tolerably accordant on the whole are deduced in this manner, but there is no explanation why they should be so combined. It may be regarded as a mode of combination of the experimental data so arranged as to allow a medium result to emerge, in spite of the immense discrepancies which he could not but have perceived would have appeared had results been deduced from every pair of successive experiments. I must not here be understood as insinuating any kind of deception on the part of this great experimental philosopher; on the contrary, he is candid in the extreme. He frequently refers to the "variation in the time of vibration and the perturbation of the resting points" as things for which he cannot account, and sometimes says, "there must be some disturbing force." Also "the force of torsion must be subject to variation." With respect to the hypothesis of a change in the torsion force, though I might grant its possibility when a single wire is employed for the suspending line, I cannot grant it when bifilar silk lines are used. In this case the force of torsion is easily calculated, and there is no reason why it should at all change. But when such lines, ·177 inch apart, are used, the greatest anomalies occur; and I am persuaded that if the distance were still further diminished, and the torsion force thereby rendered weaker, the anomalies would be still further increased.

In order to obtain a theory which would account for the anomalies I tried many plans. One was the integration of the equation of motion (including resistance) to terms of the second order, but the corrections thence arising were far too minute to afford any explanation. Besides the above reason against the alteration of the torsion force, another occurred to me, which was this,—were a change in the torsion force the sole cause of the perturbations, the time and resting point ought always to change *simultaneously*, but this is observed not to be the case. Examples in abundance will present themselves to any one consulting the tables, in which the time changes, and the resting point remains nearly unaltered, and *vice versâ*. Heat also was out of the question, in consequence of the extreme precautions used to prevent the intrusion of this sort of disturbance.

At length I determined to try the effect of a supposed *magnetic* state of the masses and balls, and, as will be seen in the sequel, the hypothesis succeeded beyond my most sanguine expectations. It is strongly suspected that all bodies are more or less susceptible of the magnetic state, and I think it very probable that what is called the coercive power of a substance, or that power which it possesses of retaining its magnetic state, after the magnetizing power has been withdrawn, for a longer or shorter period, may not only differ for different substances, which we know it does, but for different intensities of magnetization. Thus, if magnetism be induced by a powerful magnet in a mass of soft iron or lead, the magnetic state will, to all appearance, subside when the magnet is withdrawn, and that very rapidly, perhaps instantaneously. Now I contend that such may not be the case if the magnetization were very small; it may require, even in lead, some time to elapse before the very feeble magnetic state wholly subsides.

We are sure that some degree of magnetism must be induced in the masses and balls by terrestrial magnetic influence, and then the magnetic systems may be capable of sensibly influencing each other. Now when balls are magnetized, their action is the same as if there were a small magnet concentric with each ball, and therefore the mutual action of balls on each other is reduced to that of small magnets, the distance of whose centres is great compared with their lengths. In the case of the earth being one of the magnetic bodies, the distance of the centres may be well considered infinite in comparison with the lengths of the supposed magnets, and therefore magnetic action of the earth upon any body at its surface will not tend to produce any motion of translation, or to increase the *weight* of such body. But when two balls at a moderate distance from each other are magnetized, the force producing motion of translation does not vanish, except for certain relative positions of the magnetic axes, and is sometimes positive and sometimes negative; that is, sometimes attractive and sometimes repulsive. Imagine then that the masses have remained in the positive position for some hours (*e. g.* during the night); the mutual influence of the masses and balls combined with terrestrial influence must have induced a certain very minutely magnetic state in those bodies, and the resulting attraction of the masses and balls is mixed up with the attraction of their mutual gravitation. Now reverse the masses by turning the plank round the centre of motion through nearly 180°, the action arising from magnetism, if we suppose the masses capable of preserving their minutely magnetic state, will now probably be one of repulsion, though perhaps not precisely equal in amount to the magnetic attraction in the positive position. This repulsion will also be mixed up with the action of mutual gravitation.

Now, when we reflect that the attraction arising from gravitation between a mass and one of the balls is exceedingly minute (about the tenth of a grain), it is clear that an almost inconceivably feeble magnetic state may be the cause of great perturbations.

I now proceed to apply mathematics to these views. The term depending on the action of gravitation being $\frac{k\mathrm{E}}{\mathrm{F}}\, i.\varphi x$, let that depending on magnetic action be $\frac{k\mathrm{M}}{\mathrm{F}}\, i.\psi x$, then the differential equation of motion will be

$$\frac{d^2x}{dt^2}+\xi\frac{dx}{dt}+m^2(x-b)=\frac{k\mathrm{E}i}{\mathrm{F}}.\varphi x+\frac{k\mathrm{M}i}{\mathrm{F}}.\psi x;$$

and if we suppose φx and ψx expanded to the first power of x, we may write

$$\varphi x=1+ax,\ \psi x=1+cx;$$

and making

$$m^2-\frac{k\mathrm{E}ia}{\mathrm{F}}-\frac{k\mathrm{M}ic}{\mathrm{F}}=\mu^2,$$

we have

$$\frac{d^2x}{dt^2}+\xi\frac{dx}{dt}+\mu^2x=m^2b+\frac{ki(\mathrm{E}+\mathrm{M})}{\mathrm{F}}. \quad \ldots\ldots\ldots\ldots \quad (1.)$$

Let P be the value of x for the resting point or position of equilibrium, then

$$\mu^2\mathrm{P}=m^2b+\frac{ki(\mathrm{E}+\mathrm{M})}{\mathrm{F}}, \quad \ldots\ldots\ldots\ldots \quad (2.)$$

and the equation of motion may be written

$$\frac{d^2x}{dt^2}+\rho\frac{dx}{dt}+\mu^2(x-\mathrm{P})=0.$$

The integral of this equation is

$$x=\mathrm{P}+se^{-\frac{\rho t}{2}}\left\{\cos yt+\frac{\rho}{2y}\sin yt\right\}, \quad \ldots\ldots\ldots\ldots \quad (3.)$$

where $y^2=\mu^2-\frac{1}{4}\rho^2$,

and

$$\frac{dx}{dt}=-\frac{\mu^2 s}{ye^{\frac{\rho t}{2}}}\sin yt \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4.)$$

Hence the time of vibration $=\frac{\pi}{y}$.

To determine the coefficients from observation. Let A, B, C be the extreme divisions observed, and let $e^{-\frac{\rho\pi}{2y}}=u$. Then

$$\begin{aligned} \mathrm{A}&=\mathrm{P}+s, \\ \mathrm{B}&=\mathrm{P}-su, \\ \mathrm{C}&=\mathrm{P}+su^2, \\ \therefore \quad \mathrm{P}&=\frac{\mathrm{AC}-\mathrm{B}^2}{\mathrm{A}+\mathrm{C}-2\mathrm{B}}, \quad u=\frac{\mathrm{B}-\mathrm{C}}{\mathrm{B}-\mathrm{A}}. \end{aligned}$$

Now in all cases it is observed that B−C and B−A do not greatly differ, so that $u=1-v$, where v is a small quantity,

or $$e^{\frac{\rho\mathrm{T}}{2}}=1+v, \qquad \therefore \rho=\frac{2}{\mathrm{T}}\log_e(1+v)=\frac{2v}{\mathrm{T}} \text{ nearly},$$

$$\therefore \quad \mu^2=y^2+\frac{1}{4}\rho^2=\frac{\pi^2}{\mathrm{T}^2}+\frac{v^2}{\mathrm{T}^2}=\frac{\pi^2}{\mathrm{T}^2}\left(1+\frac{v^2}{\pi^2}\right).$$

In this the masses are supposed in the positive position: when they are in the negative position, if we suppose x measured from the zero point in the contrary direction, and that M becomes M′, and c becomes c', &c., we have

$$\mu'^2\mathrm{P}'=-m^2b+\frac{ki(\mathrm{E}+\mathrm{M}')}{\mathrm{F}}, \quad \ldots\ldots\ldots\ldots \quad (5.)$$

where $$\mu'^2=\frac{\pi^2}{\mathrm{T}'^2}\left(1+\frac{v'^2}{\pi^2}\right).$$

In our ignorance as to the mutual positions of the magnetic axes we do not know the precise relation of M′ to M, but as a probable and at the same time simple approximation, suppose $\mathrm{M}'=-\mathrm{M}$.

Then by adding (2.) and (5.) we have

$$\frac{2ki\mathrm{E}}{\mathrm{F}}=\mu^2\mathrm{P}+\mu'^2\mathrm{P}'.$$

Now $k\Delta=\mathrm{K}$, a known constant,

$$\therefore \quad \frac{2\mathrm{K}i\mathrm{E}}{\Delta\mathrm{F}}=\frac{\pi^2\mathrm{P}}{\mathrm{T}^2}\left(1+\frac{v^2}{\pi^2}\right)+\frac{\pi^2\mathrm{P}'}{\mathrm{T}'^2}\left(1+\frac{v'^2}{\pi^2}\right).$$

The corrections $\frac{v^2}{\pi^2}$ and $\frac{v'^2}{\pi^2}$ are found to be insignificant, and therefore

$$\frac{2}{\Delta}=\frac{P}{T^2}C^{-1}+\frac{P'}{T'^2}C^{-1},$$

where $C=\frac{KiE}{F\pi^2}=$ Baily's special constant.

Hence if $\frac{1}{\delta}=\frac{P}{T^2C}$ or $\delta=\frac{T^2}{P}C$,

and $\frac{1}{\delta'}=\frac{P'}{T'^2C}$ or $\delta'=\frac{T'^2}{P}C$,

we have $\frac{2}{\Delta}=\frac{1}{\delta}+\frac{1}{\delta'}$,

$$\therefore\quad \Delta=\frac{1}{\frac{1}{2}\left(\frac{1}{\delta}+\frac{1}{\delta'}\right)}.$$

I will now apply this method to a few examples, but instead of deducing $\frac{1}{\delta}$ and $\frac{1}{\delta'}$ from two consecutive positive and negative experiments, I will usually employ their mean values deduced from all the experiments made during a day.

Also, since A−C is usually very small compared with A+C−2B, we have $AC=\frac{1}{4}(A+C)^2$ nearly, and therefore

$$P=\frac{AC-B^2}{A+C-2B}=\frac{1}{4}\cdot\frac{(A+C)^2-4B^2}{(A+C)-2B}=\frac{1}{4}\left\{A+C+2B\right\}=\frac{1}{2}\left\{\frac{1}{2}(A+B)+\frac{1}{2}(C+B)\right\},$$

which is Baily's method, and therefore I shall take Baily's mean resting point as sufficiently near the truth.

2-inch lead balls with *bifilar silk* lines ·177 inch distant, February 26, 1841. Experiment 113, negative

log C=6·360356	P′= 11·85
log T′²=5·385954	T′=493·148
ar. co. log P′=8·926281	
·672591	
$\log\frac{1}{\delta'}$=9·327408	$\therefore\ \frac{1}{\delta'}$=·21747.

Experiment 114, positive

log C=6·360356	P= 8·312
log T²=5·409010	T=506·412
ar. co. log P=9·080294	
·849660	
$\log\frac{1}{\delta}$=9·150339	$\therefore\ \frac{1}{\delta}$=·14136

$$\therefore\quad \frac{1}{2}\left\{\frac{1}{\delta}+\frac{1}{\delta'}\right\}=\cdot17941=\frac{1}{\Delta},\qquad \therefore\quad \Delta=5\cdot5738.$$

29th Series.—2-inch zinc balls with *bifilar silk* lines ·367 inch distant, December 24th, 1841. By pursuing the same mode of calculation, log C=6·358224, I find as follows:—

Pos. Expts.	$\frac{1}{\delta}$.	Neg. Expts.	$\frac{1}{\delta'}$.
1357	·68293	1358	− ·31984
1359	·58530	1360	− ·18163
1361	·55658	1362	− ·25055
1363	·65864	1364	− ·34102
	4)2·48345		4)−1·09304
	·62086		− ·27326
	−·27326		
	2)·34760		

$$\cdot 17380 = \frac{1}{\Delta}, \qquad \therefore \quad \Delta = 5 \cdot 7537.$$

On referring to the investigation, it will be seen that neglecting the small quantity $m^2 b$*, $\frac{1}{\delta} - \frac{1}{\delta'}$, by equations (2.) and (5.) is a measure of the magnetic action during two consecutive positive and negative experiments. Accordingly we have the following table:—

Experiments.	Quantities proportional to magnetic action.
1357	
1358	1·00277
1359	·90514
1360	·76693
1361	·73821
1362	·80713
1363	·90919
1364	·99966

The apparatus is here assumed to have been in a normal state, or very nearly so.

52nd Series.—2½-inch lead balls with *single copper wire*, dist. ·0178 inch, March 20, 1842.

Pos. Expts.	$\frac{1}{\delta}$.	Neg. Expts.	$\frac{1}{\delta'}$.
1893	·27914	1894	·09847
1895	·24245	1896	·12632
	2)·52159		2)·22479
	·26079		·11239
	·11239		
	2)·37318		

$$\cdot 18659 = \frac{1}{\Delta}, \qquad \therefore \quad \Delta = 5 \cdot 3593.$$

* $m^2 b$ must be very insignificant; for no experimenter would suffer his apparatus to be so much out of order as to render it very sensible.

Experiments.	Quantities proportional to magnetic action.
1893	
1894	·18067
1895	·14398
1896	·11613

Supposing the apparatus in the normal state.

I think it is to be regretted that in Mr. Baily's experiments he should have so seldom mentioned in what position the masses had been left during the night; this last example is one of the cases in which he distinctly mentions that the masses had remained in the positive position during the night, and the first observation next morning was taken from the *spontaneous* motion of the rod. Accordingly we find the magnetic action positive, and diminishing subsequently, as we would have been led to expect from the circumstances.

The following is an instance in which the magnetic action is negative, and I have placed in juxtaposition the gravitating energy.

Dec. 8, 1841. Expts.	Magnetic action. $\frac{1}{\delta}-\frac{1}{\delta'}$	Gravitating action. $\frac{1}{\delta}+\frac{1}{\delta'}$
1229		
1230	−·59781	·36883
1231	−·61569	·35095
1232	−·63164	·36690
1233	−·63573	·36281
1234	−·64200	·36908
1235	−·65325	·35783
1236	−·66877	·37335
1237	−·69288	·34924
1238	−·71039	·36675
1239	−·72582	·35132
1240	−·74456	·37006
1241	−·76577	·34885
1242	−·79827	·38135
	Mean	·37090
		·18545=$\frac{1}{\Delta}$.

Hence $\Delta=5{\cdot}3923$.

Again, from the same series of experiments:—

Experiments.	Magnetic action. $\frac{1}{\delta}-\frac{1}{\delta'}$	Gravitating action. $\frac{1}{\delta}+\frac{1}{\delta'}$
1243		
1244	2·70630	·38762
1245	2·70244	·38376
1246	2·70090	·38530
1247	2·69498	·37938
1248	2·71824	·35612
1249	2·72141	·35929
1250	2·71262	·36808

The two last examples are taken from the 25th series, 2-inch lead balls with single copper wire, diam. ·0219 inch; and what is very remarkable is, that the time of vibration remains throughout nearly the same, 253 seconds. And since

$$\frac{\pi^2}{T^2}=m^2-\frac{kEia}{F}-\frac{kMic}{F},$$

this circumstance shows two things, first that the term $\frac{kMic}{F}$ must be exceedingly small, and therefore c very small; and also that m^2, and therefore the force of torsion is not sensibly changed.

I have therefore, I conceive, satisfactorily shown that the masses and balls do exert influences on each other independent of the action of gravitation, and that such influences are of a very fluctuating nature, and the action arising from them is either positive or negative; and changes as to sign when the masses are turned round a vertical axis through 180°, or thereabouts. Moreover, that such action may either fall short of that arising from gravitation, or exceed it many times.

It is inconceivable that this disturbing force can arise from anything but magnetic influence, and in this we must remember there are three distinct modifying causes at work,—first, terrestrial influence; second, mutual influence of masses and balls; and third, the alternate motion of the masses changing from one position to the other. I am of opinion that ordinary magnetic influence is inadequate to the explanation of the motions, or rather of the disturbing force demonstrated to have an existence, and that, as all the substances used are such as are classed by Dr. Faraday amongst the *diamagnetic*, that new magnetic condition discovered by this illustrious experimentalist is also greatly concerned as a cause. It will probably be found that both species of magnetism combine in producing such very extraordinary results. The circumstance of the numbers proportional to the gravitating influence not exactly agreeing is easily explained. The simple condition $M+M'=0$, which we have assumed, is of course not accurate, and the wonder is that it answers so well.

But we now come to the question how future experiments with the torsion balance are to be conducted so as to arrive at a satisfactory conclusion as to the mean density Δ. It has occurred to me that, instead of using diamagnetic substances, we should have hard iron balls possessing the ordinary magnetic state in sufficient intensity to render their magnetic effect sensible, so that we may with precision ascertain the magnetic axes of each iron mass and ball. Suppose the balls placed on the rod so that their magnetic axes shall be in the direction of the rod and therefore horizontal. Let the rod be suspended in the magnetic meridian, and let the masses be placed with their magnetic axes vertical, and centres in the same horizontal plane with those of the balls. The contiguous masses and balls would exert no magnetic force on each other perpendicular to the length of the rod, and the resolvent of magnetic force of a further mass on a nearer ball, or a further ball on a nearer mass per-

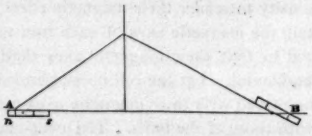
pendicular to the rod, would be exceeding small, and might possibly by some contrivance be altogether counteracted. Under such an arrangement the only effective force would be that of gravitation. I would also do away with the planks, support the masses on square blocks of wood, and transport them from the positive and negative positions by means of wooden tram-roads parallel to the torsion box, so that all motion round an axis might be avoided.

It has also struck me that by suspending the rod by means of a single silk thread having little or no power of torsion, and by having very delicate hydrometers at each end of the torsion rod, the stems of which are attached to very fine hairs or silken threads passing over small fixed pulleys in the horizontal plane of the torsion rod, the horizontal portions of the hairs or threads being affixed to the ends of the torsion rod, the experiments might be rendered purely statical. Supposing the hydrometers just floating in their position of equilibrium when the rod is in its zero position, and those hydrometers on contrary sides of the torsion rod opposed to the masses, it is clear that when the rod moves towards the masses, and raises the hydrometers above their position of equilibrium, that the tensions of the threads would increase, and vary as the angle through which the torsion rod has moved. These forces of tension would ultimately be in equilibrium with the gravitating action, and by observing this position of equilibrium the force of tension and therefore that of gravitation would become known. There may be practical objections to this arrangement, but I am of opinion that by using proper substances for the stems, &c. of the hydrometers, and proper care in the manufacture of the small pulleys, they might be overcome.

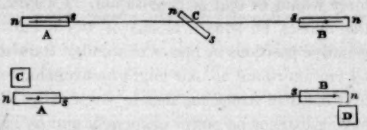
After my views were fully matured I had some correspondence with Sir John Herschel, to whom I in part detailed them, and with the kindness and urbanity which so eminently distinguish him, he undertook to lay my communication before the Royal Society: in one of his letters he thus expresses himself.

"Very many years ago, immediately after the publication of a joint paper by Mr. Babbage and myself on the magnetic action of revolving copper discs, &c. on magnets, a course of experiments suggested itself to me which, for want of a proper *locale* where I could establish an apparatus of considerable dimension and great delicacy out of the way of currents of air, I did not execute, a thing I now much regret.

"The plan of these experiments was to attach to the two arms of a long torsion balance two magnets, a stronger and a somewhat weaker; thus A being the weaker and B the stronger, A horizontal and B so inclined as *precisely* to counteract and destroy the directive power of A (by forming 'neutral couples'), the line A B being in the magnetic meridian, which would always be practicable as the superior power of B



might be weakened in any arbitrary degree by inclining it, or other modes of making the combination astatic, as for example by placing A and B (supposed equal or very nearly so) horizontal, and adding a small adjustable correcting magnet at C, &c. &c. &c.



"The whole being then inclosed in a case, it was proposed to bring near to both A and B (and on opposite sides) masses of various metals and other substances not usually considered as magnetic, with a view to increase by leverage and so place in evidence any very minute magnetic forces which might reside in the substances used.

"I think that such a course of experiments would not now be without its interest, and that the magnetic and diamagnetic powers of FARADAY would be exhibited in such a course perhaps under new and remarkable light."

I have now only further to add, that I think it would very much conduce to our knowledge of the subject to make a new series of experiments with the Cavendish apparatus as used by Mr. BAILY, but in this manner:—Carefully stating how the masses of balls were disposed previously to the commencement of the experiments, and continuing those experiments without interruption day and night by several observers relieving each other through three or four successive days and nights, with a view to ascertaining the periodicity, &c. of the magnetic or diamagnetic forces.

Of course when real magnets are attached to the rod, as I have advised when the object of investigation is the earth's mean density, it would be necessary to render the torsion rod astatic by Sir JOHN HERSCHEL's ingenious device, which, as he states, was contrived before he had had any knowledge of M. NOBILI's astatic combination of needles.

XIII. *Electro-Physiological Researches.—Fifth Series.* Part I. *Upon Induced Contractions. By Signor* CARLO MATTEUCCI, *Professor in the University of Pisa, &c. &c. Communicated by* MICHAEL FARADAY, *Esq., &c. &c.*

Received May 20,—Read June 10, 1847.

IN my third memoir upon Induced Contractions, published in the Philosophical Transactions for 1845, at p. 303, after having discussed at length the various hypotheses which appear to offer an explanation of this phenomenon, I was led to conclude that it was due to nervous influence acting through the muscle during contraction; that, in a word, it was to be referred to a kind of nervous induction. In effect, I detailed a number of experiments in that memoir, which prove that there is never any manifestation of the signs of an electric current during the contraction of the muscles; thus in exciting contractions in one of my piles composed of muscular elements, in which the circuit was completed by the galvanometer, the signs of the muscular current were never perceived to increase. Finally, I have shown that the induced contraction is propagated through a coating of turpentine, which is of a nature sufficiently insulating to arrest the passage of any electric current.

I was therefore warranted in deducing from these phenomena that in the muscles which contracted, and so produced the induced contractions, there was never any electric current generated, and that therefore the induced contraction could not be explained by a reference to any such agency.

I will now cite some new researches instituted with a view to the discovery of the nature of the phenomenon of induced contractions, which is so obscure and at the same time so important.

Observing that the slightest discharges from the jar, inappreciable by the most delicate of our electroscopes, are invariably sufficient to excite violent contractions in the frog, it appeared agreeable to analogy to suppose that the cause of induced contractions might reside in a discharge similar to that of the jar, taking place in the muscle in the act of contracting. If that had been the case, it would no longer have been a matter of surprise that the galvanometer should give no indication during muscular contraction.

I began my researches by ascertaining whether, by passing very slight discharges of the jar through the muscular masses, contraction was excited in the galvanoscopic frog, the nerve of which touched the muscle traversed by the discharge. In effect, the galvanoscopic frog never fails to contract under the influence of extremely feeble discharge, such as are elicited after a very small jar has been discharged two or three

times with a metallic arc. It is needless to say that the galvanoscopic frog remains insulated in this experiment, merely having its nerve resting upon the muscle.

In like manner it must be observed, that in the above experiment muscles were employed which had ceased to contract during the discharge, so as not to have any induced contraction.

It must then be admitted that, in spite of the good conductibility of a muscular mass, a part of the discharge always escapes to the surface of the muscle and so traverses the nerve of the galvanoscopic frog.

The occurrence of this phenomenon is still more remarkable when the nerve of the galvanoscopic frog is placed upon a metallic surface through which the shock is passed.

The phenomenon may very well be produced by passing the discharge through a plate of tin or gold upon which the galvanoscopic nerve is laid out; only in this case we have not so many successive shocks producing contraction as with the muscular arc; evidently because the jar is much more perfectly discharged through a metallic conductor than through the muscle.

The next step therefore to be verified was whether a very slight discharge passed through a muscular mass would still excite the galvanoscopic frog to contraction, even when an insulating medium was interposed between the surface of the muscle and the galvanoscopic nerve. It also suggests itself naturally to the experimenter to employ in every experiment the same insulating coatings which are known to destroy induced contractions.

In this view I have covered the muscular mass with a coating of turpentine, and laid the galvanoscopic nerve upon it. On passing very slight discharges, the galvanoscopic frog invariably contracts. I have repeated this experiment very frequently, and the only difference that I have remarked has been in the number of successive shocks acting through the turpentine. The shocks are generally fewer than when there is no turpentine. Thus with a very small jar, and without the turpentine, five or six, and even as many as ten successive shocks may be obtained, and which cause the contraction; and when the turpentine has been interposed, the shocks are from four to six. The depth of the insulating stratum was always such that a current from a pile of fifteen couples of plates could not penetrate it.

I have gilded the muscular conductor, and stretched the galvanoscopic nerve upon its surface; on passing shocks from the small jar I still had contractions in the galvanoscopic frog. In this case also it is to be observed that contraction never went beyond the second or third discharge.

Finally, on interposing very fine plates of mica between the surface of the muscle and the galvanoscopic nerve, the frog contracted at two or three successive discharges from the small jar. I will here call attention to a fact somewhat remarkable, which has always occurred in these experiments: on passing the first shock of the jar accompanied by the spark, the contraction of the galvanoscopic frog almost invariably fails.

What inferences may be drawn from these experiments to aid our decision as to whether the induced contraction admit of an explanation on the supposition of an electric discharge similar to that of the jar, and taking place during the contraction of the muscle?

Before examining this point, I will relate a few other experiments upon the induced contraction which throw some light upon the interpretation of this phenomenon.

In a living dog, the spinal marrow (deprived of its membranes), the brain, the sciatic nerve, and the muscles of the thigh were all laid bare. Galvanoscopic frogs were placed in the usual manner upon these several parts, and at the same time the animal was irritated either by squeezing his paw, or by wounding the coverings of the spinal cord. The muscles of the thigh were thrown into violent contraction, and the animal howled from pain. In the meantime the galvanoscopic frogs placed upon the muscles in contraction alone exhibited the phenomenon of induced contraction. The same experiment was instituted upon a rabbit, and was followed with the same results. In like manner galvanoscopic frogs were arranged upon the abdominal viscera of a living rabbit while an electric current was passed along the pneumogastric nerves, or through the solar plexus. Never in the above experiments did the galvanoscopic frogs exhibit any indication of induced contractions. Now if it be borne in mind that in the experiments just related, while the animal shrieked with pain and was convulsed, there certainly was a current of that force, whatever may be its nature, which we term nervous, and yet no contraction in the galvanoscopic frogs placed on the nervous structures, we are forced to conclude *that the phenomenon of induced contraction belongs exclusively to the muscle in the state of contraction.*

With regard to the question whether the induced contractions admit of being explained by the supposition of an electric discharge elicited in the act of the contraction of the muscle, we are obliged to confess that the experiments recorded in the commencement of this memoir (and which are the only ones that in the present state of the science could have been instituted with a view to the decision of the question) are insufficient to afford a satisfactory solution.

Admitting that an electric shock analogous to a very slight discharge of the jar did actually take place during the contraction of the muscle, we should have no other means of ascertaining its existence than that of the induced contractions, the origin of which we seek to discover.

In effect, not one of our electroscopic instruments is capable of disclosing to us the existence of an electric discharge, such as that given by a very small jar previously discharged three or four times successively with a metallic conductor.

The galvanoscopic frog alone can indicate the existence of these discharges.

Respecting the influence of the coating of turpentine upon the two phenomena under consideration, induced contractions, and discharge through a muscle which acts likewise upon the galvanoscopic frog, we have seen that no difference existed between the two cases.

A difference, however, does exist on interposing a lamella of gold or of mica between the galvanoscopic nerve and the muscle: these lamellæ prevent the induced contractions without destroying the effect of the discharge of the jar. I am far from concluding from the above fact that the two phenomena may not have the same origin. We have no precise knowledge as to why the discharge of the jar can be very slight without its ceasing to excite contraction in the galvanoscopic frog; and we have seen in those cases in which the lamellæ of mica or of gold were interposed, that the number of successive discharges from the jar, which acted upon the galvanoscopic frog, was always less than when no lamellæ were interposed.

We must therefore pause a little before we can establish the fact of induced contractions not being due to an electric discharge produced during the contraction of the muscle; and since it is impossible for us to solve the question by direct experiment, let us be guided by such analogies as appear to have the best possible foundation. I purpose examining this field of investigation in a general summary of all my electro-physiological researches, which summary I hope soon to be able to complete.

PART II.

Upon the Phenomena elicited by the passage of the Current through the Nerves of a living Animal, or an Animal recently killed, according to the direction of the Current.

In my fourth memoir I took great pains to prove at length by the aid of experiment, that the electric current transmitted along a nerve modifies the excitability of the nerve in a manner differing widely according to the direction of the current; thus the direct current rapidly exhausts this excitability, while the inverse current increases it. Starting from this fact, I hope that I have given a satisfactory theory of electro-physiological phenomena.

Among the different experiments described on this head, I indicated one in particular which appears very singular, and which I have since studied in all its bearings. The frog prepared in the ordinary manner, and divided in the pelvis, is placed astride between two little glasses in which the reophores of a Faraday's pile of fifteen or twenty elements were immersed. It is evident that one of the limbs is traversed by a direct current and the other by an inverse current. It is unnecessary to describe here minutely the phases of the phenomena which present themselves during twenty or twenty-five minutes.

In the first place, the two limbs contract both on closing and on opening the circuit, after which there is contraction of the limb traversed by the direct current on closing the circuit; and the other limb contracts on breaking the circuit: finally, only one limb contracts, viz. that of the inverse limb on the cessation of the passage of the current. On keeping the circuit closed for some minutes, we invariably remark that the inverse limb, which contracts on breaking the circle, is seized with a permanent contraction of a decidedly tetanic character. This phenomenon is of importance,

as it indicates an intimate connection between nervous influence and the action of the electric current according to the direction of the latter.

I have therefore exercised the greatest care in studying this phenomenon; and if I have not been able to show the connection in all its evidence, and to express it with that degree of simplicity which is the characteristic of physical laws, I venture to hope that this failure will in part be attributed to the obscurity in which the subject is involved, and that some degree of favour may be accorded to the efforts which I have made in this direction. It is a very rare circumstance to find a frog that does not present the phenomenon which has been already described; and in particular those frogs which pass several days in winter without nourishment, never fail to manifest it. In this case they appear more disposed to become tetanic; and, in effect, they do almost all become so when they are prepared by dividing their spinal marrow, and remain so during some seconds. The phenomenon in general manifests itself after the current has been passed for twenty-five or thirty minutes. The tetanic contraction lasts a very long time, and it often happens that when this has ceased, there are twitchings in the limb from time to time. These phenomena equally occur on passing the current through the nerves without its traversing the muscles. In like manner they may be elicited in the living frog, only in this case the tetanic contraction lasts a much shorter time. The phenomenon never occurs when the current acts only on the muscle, which it may be made to do by disposing the frog in the ordinary manner, without having divided the pelvis. On the other hand, it presents itself after the spinal marrow has been destroyed.

It is not essential to the manifestation of the phenomenon in question that the muscles should be thrown into contraction at the commencement of the passage of the current, which may easily be seen by closing the circuit by the aid of a bent metallic conductor ending in some paper which *slowly* imbibes a certain quantity of water. If, instead of arresting the current by removing one of the reophores of the pile, a metallic arc be introduced between the two glasses, the tetanic contraction occurs just the same. But if to the end of this curved rod be attached some paper, so as to occasion the passage of the current to cease more slowly as regards the frog, then instead of one tetanic convulsion we have a series of contractions succeeding each other at short intervals of time.

In whatever manner the current through the nerve of the inverse limb is arrested, the tetanic contraction is excited. It suffices for this to moisten the nerve with a large drop of water, or to double it back upon itself for the contraction to take place; while this does not occur if the current is arrested for the muscle. This is easily effected by bringing the reophore of the pile, while the circuit is still kept closed, in contact with the thigh at the point where the nerves immerge.

The following experiment proves still more clearly the part which the nerve plays in this phenomenon. If, while the circle remains closed, and it has been previously ascertained that the tetanic contraction will follow the opening of the circuit, the

nerve be divided rapidly at the precise point where it enters the muscle, the limb is thrown into contraction without its remaining in a state of tetanus. But if, instead of this, the nerve be divided higher up near to its issue from the spinal marrow, then the tetanic contraction takes place as usual.

We will next consider the circumstances which modify or destroy this phenomenon. None of those frogs which were killed after the administration of large doses of morphine, so as to manifest every symptom of narcotism, ever exhibited tetanic contractions. The same thing occurs with frogs which have been made to support heavy weights with their legs. The circumstance which suddenly puts a stop to the tetanic contractions is the passage of the inverse current, the same, that is to say, by which the phenomenon is produced. Generally two or three seconds after the circle is closed again, the limb falls into its natural posture. If, on the other hand, the current merely ceases to pass, it will in general be three minutes before that happens; and the same is the case pretty nearly if the direct current is passed. To obtain these phenomena with great precision, care must be taken not to reverse the direction of the current upon the same nerve several times successively.

I was desirous of trying whether the species of tetanic contraction, or rather of corpse-like rigidity with which a muscle is seized after a shock from the jar, was dissipated by the passage of the current, direct or inverse, through its nerve. This is not at all the case, and whenever it has occurred, the passage of the current has not produced contraction.

I will here state that, acting with the electric current upon the nerves of living warm-blooded animals, as rabbits and dogs, a phenomenon analogous to that which we have studied in the frog is very clearly seen to follow the action of the inverse current; only it is observable that in these animals the tetanic contractions last a much shorter time, especially if the vitality of the animal is very great; the same fact besides is verified in the frog.

How is this tetanic action produced? It is easy to convince oneself, if any doubt could be entertained upon the subject, that there is no electricity rendered latent either in the nerves or in the muscles by the passage of the inverse current. My endeavours to discover signs of any, by the aid of the condenser, have been entirely fruitless. Likewise there are no signs on opening the circuit of any electric current in circulation. I have made myself quite certain of this fact by means of the galvanometer, employing at the same time a pile of tetanized frogs.

The phenomenon which we have studied thus at length belongs clearly to the nerve, and takes its origin from the relation, the nature of which is yet undetermined, which exists between nervous influence and the action of the electric current according to the direction of the latter.

It has been distinctly proved in the fourth series of these electro-physiological researches, that the passage of the direct current destroys the excitability of the nerve, and that this is not the case with the inverse current, which acts in a contrary

manner. The direct current acts by exciting, when it commences, a contraction which we know to be stronger than that produced in the same case by the inverse current. A limb traversed by the direct current may be compared to a limb fatigued by repeated efforts. The inverse current may be supposed to act in an opposite manner, and during its passage the nervous force might accumulate in the nerve.

I prefer, however, suppressing considerations of this nature on account of the vague and uncertain impression which they are calculated to leave in a reflecting mind.

It may not, however, be without some utility to close my electro-physiological researches with an attempt at embracing, under some general views, the phenomena of muscular contraction, of the production of electricity in fish, and of the relation between the electric current and nervous influence.

I would here recall the facts discovered by M. Longet and myself, on treating the motor nerves with the electric current. Monsieur Longet and myself discovered that the action of the electric current upon these nerves was precisely the opposite of its action upon the mixed nerves.

The direct current acting upon the motor nerves, determines the contraction in the second period of the excitability of these nerves when it ceases to pass, and the inverse current produces it when it begins to pass. It is natural to think that the phenomenon of tetanic contraction would be produced by the cessation of the direct current when the motor nerves are acted upon. In connexion with this subject, I will here relate a phenomenon which I have lately discovered, and which appears to me to be worthy of remark. With the aid of a wheel armed with insulating metallic teeth, similar to that of Mons. Masson, I passed a current in a frog prepared in the manner described above, that is to say, like that placed astride between two glasses. In this manner I pass the current 500 or 600 times in the frog. After this, on attempting to interrupt, and then again establish the circuit, the following phenomenon strikes the experimenter. The inverse limb contracts on closing the circle, and the direct limb on opening the circle. On leaving the circle closed for some minutes, the ordinary phenomena—the opposite of the preceding—appear; that is to say, the direct limb contracts on closing, and the inverse limb on breaking the circle. It is very difficult to reproduce these phenomena in the same frogs, on account of the extreme feebleness produced by the numerous contractions.

The above fact establishes a fresh connection between nervous influence and the passage of the electric current according to the direction of the latter. I will return to this subject in the general views which I announced above.

Pisa, December 1846.

XIV. *Electro-Physiological Researches.—Sixth Series. Laws of the Electric Discharge of the Torpedo and other Electric Fishes—Theory of the production of Electricity in these animals.* *By Signor* CARLO MATTEUCCI, *Professor in the University of Pisa, &c. &c. Communicated by* MICHAEL FARADAY, *Esq., F.R.S., &c. &c.*

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THE present memoir is not a mere description of a certain number of facts lately discovered on the electricity of electric fishes; besides this, and more than this, it contains the laws and theory of these phenomena. Consequently the order of exposition of the facts in this memoir will be the same as that which a scientific arrangement of the subject would dictate.

It is needless to remind the reader that the discharge of the electric fishes is subject to the will of the animal.

On irritating any point of the body of an electric fish, it is easy to demonstrate by experiment that this irritation is transmitted by the nerves to the fourth lobe of the brain, and that then only the discharge takes place. If the spinal marrow be divided at any part of its length in a living torpedo, every kind of irritation below the point of section fails to produce any effect.

It is equally easy to prove that the nervous action by which the discharge is determined under the influence of the will, resides in the fourth, or *electric lobe* of the brain; in effect, after the three superior cerebral lobes have been extracted, the torpedo can still give the shock either voluntarily, or from external irritations.

We also know that if one of the electric organs of a living torpedo be rapidly detached, we can still obtain the discharge on irritating one of the nerves ramified within the organ.

We have also shown, some time ago, that on acting upon these nerves with the electric current, we obtain the discharge under the same conditions and the same laws as those under which we have muscular contraction on acting upon the mixed nerves. Hence the remarkable analogy found to exist between muscular contraction and the electric discharge of fishes.

The most singular and the most important fact in a theoretical point of view is the discharge which we obtain when we take a very small part of a prism of the electric organ of the torpedo, and irritate it in any manner. Electric discharges always take place, as is shown by the contractions of the galvanoscopic frog.

I have very lately repeated this experiment in a variety of ways, and have always found that, on irritating one of the small nervous filaments distributed to the organ,

we obtain the discharge from that small portion of the organ into which the nerve penetrates. We have thus every reason to conclude that the electric organ of the torpedo and of all the electric fishes is composed of a great number of elementary organs, and that the elementary organ is nothing else but a nervous fibril in contact with a small cell filled with albumen. And since this cell gives an electric shock when it is subjected to nervous action, we are compelled to admit that under nervous influence the two opposite electricities separate to be instantaneously re-united.

This relation between nervous influence and electricity is, without doubt, of the same nature as that which exists between heat and electricity, between the electric current and magnetism. It is in studying the production of electricity in the different electric fishes, together with the distribution of nervous filaments in their electric organs, that we arrive at a better understanding of this relation between nervous influence (la force nerveuse) and electricity. Thus we see in the torpedo and gymnotus—the two electric fishes best known physically and anatomically—that the nervous filament always ramifies in the electric organs of these fishes perpendicularly to the axis of the prisms of these organs. Besides which we know that the extremities or poles of the electric organs in these two fishes are situated at the extremities of the prisms: in effect, in the torpedo these poles are the ventral and dorsal surfaces, while in the gymnotus the poles are at the head and tail of the animal.

It will be seen from this, that in this action of the nervous force, as exercised in the electric organs of these fishes, it follows the same law in developing electricity as does the electric current upon magnetic bodies. In effect, each prism of these electric organs cannot be considered otherwise than as a pile of elementary organs, upon each of which a nervous filament is spread normally to the axis of this pile. Now a cylinder of cast iron enclosed in a helix of metallic wire, and traversed by the electric current, is evidently an apparatus analogous to a prism of the electric organ of the fish at the moment when the nervous influence excites the discharge.

On one side we have the two opposite states of electricity, the tension of both of which must increase at the extremities of each prism in proportion to the number of elementary organs of which it is composed; on the other hand, we have opposite magnetic states, the strength of which at the poles is also proportional to the number of magnetic elements of the cylinder.

Experience has in fact shown, both in the torpedo and in the gymnotus, that the strength of the current obtained during the discharge is proportional to the length of the prisms included in the circuit closed. I have frequently seen, on dividing the electric organ of the living torpedo in a plane parallel to the surface of the organ, that the sum of the currents given by the different slices of the organ were approximatively equal to the current given by the entire organ. These same facts are verified also by including different points of the electric organ of the torpedo in the circuit; we know, in effect, that the current is stronger when points near the median line of the animal are touched, than when more remote points are. Nothing is easier than

to verify upon the gymnotus the fact that the strongest discharge is that obtained on including the entire length of the animal within the circuit.

In comparing the discharge of the torpedo with that of the gymnotus, so far as it is possible to do so, it is somewhat surprising to see that the two discharges are not so far different as they should be to be in proportion to the length of the prisms in the two animals.

But anatomy furnishes us with the key to this apparent anomaly, and shows us that the length of the prisms in the torpedo may be considered equal to that of the gymnotus, inasmuch as the number of elementary organs in the former is at least ten times as great as in the latter.

As regards the constancy in the direction of the current in the discharge of the electric fish, it results necessarily from the unvarying direction in which nervous influence is propagated through the nerves of the electric organs.

Experience has clearly shown that these nerves are charged with the sole function of exciting the discharge, so that the nervous action must constantly be propagated in a direction from the brain to the nervous extremities; the direction in which the separation of the two opposite states of electrical excitement ought to take place in the electric organ, must also necessarily be constant.

Finally, it results from all that has been said above, and it is proved by a vast number of experiments, that there exists between the nervous force and the electric states developed in the electric organs of fishes, that same relation or degree of intensity which always exists between two phenomena of which one is the cause of the other, such as exists between the electric current and the magnetism which it gives rise to.

In effect, without stopping to insist too much on what may be but vague in the physiological data, I cannot but admit that the nervous force increases independently of the will, with every increase in the activity of the functions of circulation and of respiration, and of every act of nutrition, as also under the influence of certain agents introduced into the organism. A great many experiments have fully convinced me that the electric shock of the torpedo increases with these same vital actions. Thus the torpedo in water, a little above the ordinary temperature, produces stronger discharges; the effect is precisely opposite if the respiration or the circulation of the blood of these fishes be hindered. The torpedo and the gymnotus give discharges decreasing in strength in proportion to the number given, and they reacquire their faculty of giving more powerful shocks after an interval of repose. The torpedo, over-excited by nux vomica, gives shocks more powerful than usual. This last and the preceding facts establish the connection between the intensity of the nervous force and that of the electric discharge of fishes.

I trust that I have demonstrated in this memoir, which contains the summary of my numerous researches upon the phenomena of electric fishes, that there exists in the electric organs of these fish a very simple case of relation between nervous force and electricity, established by well-determined laws.

Pisa, January 1847.

XV. *Electro-Physiological Researches.—Seventh and last Series. Upon the relation between the intensity of the Electric Current, and that of the corresponding physiological effect. By Signor* Carlo Matteucci, *Professor in the University of Pisa, &c. &c. Communicated by* Michael Faraday, *Esq., F.R.S., &c. &c.*

Received May 20,—Read June 10, 1847.

In bringing to a conclusion my series of researches on electro-physiology, I shall dwell in the present memoir on such of them as have frequently engaged my attention, and which I have lately again enlarged upon as bearing directly upon the highest, and I would even say, most physical point of the science of electro-physiology.

We admit as clearly demonstrated by experiment that electro-magnetic, as well as electro-chemical action, give the measure of the electric current; in other words, that different quantities of electricity produce chemical and magnetic effects proportional to these quantities. What then is the nature of this relation between the quantity of electricity and the contraction thereby excited, when transmitted through the nerve of an animal either living or killed as recently as possible? In an early memoir, published three years ago in the Ann. de Chem. et de Phys., and in a communication which I had the honour of making to the British Association at York, I described my first experiments on this subject. Nevertheless I have always been desirous of being able to renew these experiments with far more perfect instruments than I possessed at that time.

All the apparatus which I have employed were executed by M. Breguet with his accustomed skill and talent. The principal among them (Plate XII. fig. 1) has been already described in my Fourth Series. In the course of the present memoir I will give the description of the other instruments.

The following is the general disposition of the experiment. A frog prepared rapidly is reduced to a thigh with the leg, the lumbar nerve, and a morsel of spinal marrow. An electric current, or a discharge from the Leyden jar, is passed through a certain length of this nerve. The electro-physiological effect is the contraction of the limb, which at the expiration of a given time is raised to a certain height. Let a determined quantity of electricity now be passed, then the half, a third, a fourth of that quantity, and so on, and a measure be taken of the corresponding electro-physiological effect; that is to say, of the height to which the limb is raised, and within what time.

It will be seen from this that there is no difficulty in putting forward the subject of the research, but the practical difficulty is very great. It is needless to describe

in what this difficulty consists, it being sufficiently apparent in itself. I have therefore confined my efforts to the discovery of the relation between the electro-physiological effects, and the quantities of electricity which produce them, finding it almost impossible to arrive at approximative measures of these absolute effects.

On passing an electric current from different piles along the nerve of a frog disposed in the apparatus described in my Fourth Series, fig. 1, and noting the movements of the index in the different cases, it will be perceived that the limb is raised to the same height for very different currents. Thus I have found that a current from a GROVE's pile of six couples of plates, and one from six of a FARADAY's pile with and without a powerful magnet in the circuit, and finally a current from only one couple of WHEATSTONE's plates, give the same number of degrees for the movement of the index of my apparatus. It is clear from the above that all these currents are too strong for the effects to be compared together; it would be precisely the same case if we were to pretend to measure different currents with a galvanometer the needle of which is propelled to 90° by the most feeble of these currents. The real object, therefore, to be ascertained was the feeblest current which produced the greatest possible medium contraction. I succeeded in the following manner in discovering this. I employed a small WHEATSTONE's pair of plates, of constant force, introducing within the circuit a cylinder of distilled water. This water is contained in a glass tube a centimètre in diameter, and bent in the form of the letter U. By plunging the metallic conducting wires more or less deeply in this tube, I vary at will the resistance of the circuit. The following are all the details of the experiment. The WHEATSTONE pair of plates was exactly like that described in the memoir of that skilful experimenter; the circuit is composed of a copper wire covered with silk, and half a millimètre in diameter, which serves to close the circuit interrupted by the cylinder of distilled water. The extremities of the wire which dips in the cylinder were of platinum; the length of the copper wire in all about three mètres. The circuit was closed and broken by rapidly plunging one end of the wire, held in the hand, into a capsule of mercury. Both the pile and my apparatus were perfectly insulated, and the copper wire which served to close and break the circuit was varnished at that part which was held in the hand. The depth to which the current, which I call limited, penetrated within the column of water was about eighty-eight centimètres (in the case of very vivacious frogs rapidly prepared) during the first fifteen or twenty contractions. In order to render these experiments as comparable one with another as is possible in this kind of research, it is necessary that the circuit be broken always at equal intervals of time. I leave the circuit closed as short a time as possible, and invariably allow from fifteen to twenty seconds between one experiment and the other. I always employ the direct current for reasons well-known.

The difference occasioned by the column of eighty-eight centimètres of water, and which showed that I had arrived at the limited current, was very manifest in my apparatus; thus at a depth of a few centimètres less I had the highest indication, the

same as that given when the stratum of water was not included in the circuit. With the column of water eighty-eight centimètres in depth, the indication was lessened by from 2° to 4°, and with a column of from ninety to ninety-five centimètres the diminution was very sensible.

In the very numerous experiments which I have instituted on this subject, I have always, in each in particular, sought for the length of the stratum of water which gave the limited current. I repeat that it was very easy to effect this by approximating the wires more or less in the water. It remains now to be considered by what means the half, a third, a fourth of the quantity of electricity was made to pass into the same nerve. After several trials I returned to my first plan as being the least inexact possible. When I wish to pass half the quantity of electricity through the nerve, I interpose a second nerve between the forceps and the thigh; to pass a third of the current I add two nerves, and so on. Theoretically, and with regard to the great resistance of the circuit, it may be admitted as true that the half of the current passes into each of the two nerves, and a third into each of the three nerves, the same ratio being observable according as the subdivision of the current proceeds; but having respect also to the bad conductibility of the nerve, which is certainly, from its nature* and dimensions, at least as great as that of the stratum of water, it might be imagined that in increasing the number of nerves the total current would be also augmented, and by that means rather more than the half of the current which passed into one nerve would pass in the case of the two nerves; in the case of the three nerves, somewhat more than a third of the current for each nerve; and so on. By introducing a galvanometer within the circuit, we are able to ascertain the very slight augmentation produced by the nerves successively added†.

In order that these nerves might be similar in all points, as nearly as possible, they were always taken from frogs prepared at the same time as the frog which served for the experiment. Care must be taken in placing them side by side not to allow them to touch one another. I have invariably observed that when this happened, and that the nerve of the frog within the apparatus was enveloped by the nerves added subsequently, there were no longer any signs of contraction on passing the current, though these were immediately manifest when the same number of nerves were prevented from contact with one another. I look upon this result as a further proof that the cause of contraction from the passage of the electric current, is the discharge which takes place at the commencement and at the termination of the circuit.

The following is the march of the phenomena in these experiments. If we begin to add the second and third, &c. nerve while the current is still tolerably far from

* A hempen thread soaked in water, and a nervous filament as nearly as possible of the same dimensions, offer degrees of resistance which are in the following ratio, twelve for the moist thread, and fifteen for the nerve. The nerve must be very fresh to afford this resistance: it naturally increases in proportion as it becomes dry.

† In performing these experiments, I have found that if the stratum of water was more resisting than the nerve, there was no perceptible increase in the current from adding two, three, or four nerves to the circuit instead of one. In my experiment the resistance of the column of water is greater than of the nerve.

its limit, we invariably observe that the contraction remains the same, or nearly so, as when there was no other nerve than that of the frog contained in the apparatus. On the contrary, if these experiments were not performed until the current was less than the limited current, then, after the second nerve had been added, there was no longer any contraction that could be measured.

It is, I repeat, by taking our departure from the limited current that we must determine in every case, performing the experiments with all the precautions described, and always being careful to wait until the natural contractions of the frog have ceased; and in this manner we may attain to numerical results which will admit of being compared together.

Before stating these numbers I must speak of a research which it was necessary to make in order to render these results as exact as possible. I allude to the duration of these contractions, both great and slight. I have measured these with the apparatus (figs. 2, 3, 4), which appears to me analogous in principle to that upon which the instruments invented by Messrs. Wheatstone and Breguet for measuring the velocity of projectiles are founded.

This is a magnet (*a*, fig. 4), the anchor (*b*) of which is moveable, and at each movement strikes against the knob of a chronometer (*c*). The small weight (*o*, figs. 2, 3) which the frog raises in contracting is constructed in such a manner as to complete or break the circuit of the magnet. When the contraction takes place the circuit is broken, and it is re-established an instant afterwards when the contraction ceases. It then is broken again, and so continues to alternate. It will be seen from this that the interval of time elapsed between two successive contractions executed without any time being lost between them, will be marked by the chronometer.

I have found that in this manner the interval is constant for the first ten or fifteen seconds, during which it is $0''{\cdot}25$; after which it becomes longer, and remains $0''{\cdot}33$ for ten or fifteen seconds longer, and afterwards it becomes $0''{\cdot}41$, $0''{\cdot}58$, &c.

By varying the length of the stratum of water in three different experiments and with the frog still vivacious, my apparatus showed contractions differing from 6° to 10° up to 28° or 32°. The duration of the interval was perceptibly the same in all ($0''{\cdot}30$ to $0''{\cdot}33$).

Finally, it remained to measure the duration of the two different acts which are produced in the frog's limb in the interval between one contraction and the next, that is to say the limb is raised and contracts, then ceases to contract and falls.

I employed to ascertain this the same method which, I believe, the celebrated Watt adopted in the first instance for determining the velocity of the pistons in his machines. A fine point was attached to the little shank fastened to the leg of the frog, which point scraped, during the contraction, against a rapidly revolving smoked disc, of which the rotations were perfectly uniform.

The trace which the point leaves on the disc during its elevation may serve to indicate the duration of this elevation when it is known how long it takes to perform one revolution of the disc. The disc I used performed forty-eight revolutions in $1''$.

I have found from a great number of experiments, that the duration of the true contraction was much shorter than that of the descent or return of the limb, and that the difference became so much the greater as the muscle became fatigued.

I estimate the real contraction in my experiments at less than $\frac{1}{100}$th of a second. This duration was perceptibly the same for both great and slight contractions.

The following table shows the numbers found in a great variety of experiments conducted in the manner described, the number of nerves being varied.

I will only give a certain number of my experiments without making any selection therefrom.

	Number of nerves.	Degrees of contraction.		
First experiment	3	6	8	8
	2	10	10	10
	1	24	22	14
Second experiment	3	11		
	2	22		
	1	30		
Third experiment	2	12	14	
	1	26	28	
Fourth experiment	3	8	6	
	2	14	16	
	1	26	26	
Fifth experiment	3	6		
	2	14		
	1	24		
Sixth experiment	2	20	16	
	1	32	28	
Seventh experiment	1	6	6	
	2	3	4	
Eighth experiment	2	12		
	1	20		
Ninth experiment	2	6		
	1	10		
Tenth experiment	3	3		
	2	10		
	1	20		

Examining attentively the numbers which I have just exposed, and taking into consideration the reflections made above, and those principally which establish the fact, that the total current increases perceptibly with the number of nerves, it appears to me that we ought to conclude from these experiments that it is sufficiently demonstrated, and true as far as this kind of experiment admits of demonstration, that the electro-physiological effect is proportional to the intensity of the current.

Pisa, February 1847.

Postscript.

Received May 20th, 1847.

Extract from a Letter from Professor Matteucci to Mr. Bowman, dated Pisa.

(*Translation.*)

"As I do not propose to resume my electro-physiological researches, at least for some time to come, I should feel obliged by your adding the following fact, which is a very striking one, to the memoirs just presented to the Royal Society.

"You know the law of the electro-physiological action of the current on mixed nerves: you know that this law is very different in the case of the simple nerves of the anterior roots, as I found in conjunction with Longet.

"Now, if you render a rabbit or a dog insensible by the inspiration of sulphuric ether, and, while in that state, pass the direct current along one sciatic nerve, and the inverse along the other, you will have the following phenomena:—

"1st. If the animal is not *totally* insensible, some cries of pain at the commencement of the *direct* current, which continue more or less while it is passing, but *no contraction*: the contraction with this current only appears on *interrupting* the current.

"2nd. With the *inverse* current, no cry or sign of pain on completing the circuit, if the animal is thoroughly etherized, and slight cries if not quite etherized: *contraction* of the muscles in *closing*, *none* on *opening* the circuit.

"These are the phenomena of the anterior roots.

"3rd. Now cut the nerves at their insertion into the spinal marrow: instantly the phenomena are reversed, and we have the ordinary play of the mixed nerves; that is to say, the *contraction* with the *direct* current takes place on *closing*, and that with the *inverse* current on *opening* the circuit.

"In the mixed nerves, therefore, the phenomena are complicated by the presence of the sensitive fibres.

"This conclusion appears to me very important, and I much regret that I am unable to tell you that the same things occur with the frog. Etherized frogs give the ordinary phenomena of mixed nerves, as heretofore.

"But who knows how the two kinds of fibres mingle in the nerves of different animals? Who is so ignorant as to believe that, in such matters, he can know all, and all at once?"

XVI. *On the Value in Absolute Alcohol of Spirits of different Specific Gravities.*

By GEORGE FOWNES, *Esq.*, *F.R.S.*,
Professor of Practical Chemistry in University College, London.

Received June 7,—Read June 17, 1847.

HAVING been for some months past occupied with experiments on the fermentation of sugar and molasses, and having found it necessary to construct for this purpose a new table of the quantity per centum by weight of absolute alcohol contained in spirits of different specific gravities, I venture to lay the same before the Royal Society, hoping that it may be found generally useful in inquiries of this kind, and also for other purposes.

The Table was formed synthetically; absolute alcohol and distilled water were weighed out in the required proportions, mixed in small well-stopped bottles and well-shaken together. After standing three or four days the mixtures were brought to the temperature of 60° FAHR. exactly, and their specific gravities determined with great care. After the lapse of two or three days more this last-named operation was repeated, but in no case was it observed that any further contraction had occurred. Neither was the specific gravity of a mixture containing nearly equal parts alcohol and water which had been so examined changed by being inclosed in a strong accurately-stoppered bottle, and heated for some time to a temperature above its boiling-point.

In this manner each alternate number in the Table (each even number) was obtained by direct experiment; the others were then interpolated. When completed, the Table was examined by various methods calculated to test its accuracy, but no error of sufficient magnitude to limit its usefulness was detected.

The absolute alcohol employed in these experiments was prepared in the following manner:—the strongest rectified spirit was agitated with half its weight of carbonate of potash deprived of water of crystallization, and left in contact with the salt some days. It was then decanted upon half its weight of powdered quicklime, made from black marble, contained in a metal still which could be perfectly closed. The mixture of spirit and lime was retained in a warm situation for a week or thereabouts, and then distilled by means of a water-bath. By this treatment the specific gravity of the alcohol was generally reduced to ·796 or even below, and by a repetition of the process of digestion with powdered lime and re-distillation, the last traces of water were removed. In this manner, without difficulty, the very considerable quantity of absolute alcohol required for the experiments was procured.

Absolute alcohol thus obtained has the specific gravity ·7938 at 60° Fahr.; it is extremely expansible by heat, which renders the determination of its exact specific gravity difficult and troublesome when the temperature of the room is either above or below 60°. The same remark applies to the mixtures of alcohol and water extending over more than half the Table, the most minute precautions regarding temperature being necessary to avoid serious errors. In a glass retort containing pieces of copper-foil absolute alcohol boils at 177° Fahr., the barometer standing at 29·75 inches. Lastly, when analysed by combustion with oxide of copper, it yields numbers representing the proportions of carbon and hydrogen present so closely agreeing with those required by theory, as to leave no doubt of its purity and freedom from all admixture.

The contraction of volume suffered by various mixtures of alcohol and water may be rendered obvious by comparing the actual specific gravities of such mixtures with the calculated mean specific gravities. In the accompanying Plate (XIII.), in which the vertical lines represent the per-centage of alcohol by weight, and the horizontal lines the specific gravities, the calculated mean specific gravities of the mixtures are seen to form a straight diagonal line from corner to corner, while the actual specific gravities form an irregular curve with upward convexity, rising quickly to near its maximum deviation at 30 per cent., running nearly parallel with the other line to 50 per cent., and thence declining until it reaches the extremity of the scale.

University College,
June 7th, 1847.

Table of the proportion by weight of real or absolute alcohol contained in 100 parts of spirits of different specific gravities at the temperature of 60° Fahr.

Specific gravity.	Per-centage of alcohol.	Specific gravity.	Per-centage of alcohol.	Specific gravity.	Per-centage of alcohol.
·9991	0·5	·9511	34	·8769	68
·9981	1	·9490	35	·8745	69
·9965	2	·9470	36	·8721	70
·9947	3	·9452	37	·8696	71
·9930	4	·9434	38	·8672	72
·9914	5	·9416	39	·8649	73
·9898	6	·9396	40	·8625	74
·9884	7	·9376	41	·8603	75
·9869	8	·9356	42	·8581	76
·9855	9	·9335	43	·8557	77
·9841	10	·9314	44	·8533	78
·9828	11	·9292	45	·8508	79
·9815	12	·9270	46	·8483	80
·9802	13	·9249	47	·8459	81
·9789	14	·9228	48	·8434	82
·9778	15	·9206	49	·8408	83
·9766	16	·9184	50	·8382	84
·9753	17	·9160	51	·8357	85
·9741	18	·9135	52	·8331	86
·9728	19	·9113	53	·8305	87
·9716	20	·9090	54	·8279	88
·9704	21	·9069	55	·8254	89
·9691	22	·9047	56	·8228	90
·9678	23	·9025	57	·8199	91
·9665	24	·9001	58	·8172	92
·9652	25	·8979	59	·8145	93
·9638	26	·8956	60	·8118	94
·9623	27	·8932	61	·8089	95
·9609	28	·8908	62	·8061	96
·9593	29	·8886	63	·8031	97
·9578	30	·8863	64	·8001	98
·9560	31	·8840	65	·7969	99
·9544	32	·8816	66	·7938	100
·9528	33	·8793	67		

XVII. *On different Properties of Solar Radiation producing or preventing a deposit of Mercury on Silver Plates coated with Iodine, or its compounds with Bromine or Chlorine, modified by Coloured Glass Media and the Vapours of the Atmosphere.*

By A. Claudet, *Esq.* *Communicated by Sir* David Brewster, *F.R.S., &c. &c.*

Received June 10,—Read June 17, 1847.

FROM the commencement of photography it has been known that the red, orange, and yellow rays exert but a very feeble photogenic influence on the Daguerreotype plate. The experiments of several philosophers, especially those of Sir J. Herschel on photogenic papers, published in February 1840, prove that this action is more particularly confined to the most refrangible part of the prismatic spectrum, commencing from the space found covered by the blue rays and extending to the extremity of the violet, and sometimes even beyond it.

In 1839, Sir J. Herschel observed that the red rays exercised on several photogenic papers an antagonistic action to the photogenic rays, modifying their effect. Contrary to this, in 1841, M. Ed. Becquerel presented to the Paris Academy of Sciences a memoir, in which he announced that the red, orange and yellow rays were endowed with the property of continuing the action commenced by the photogenic rays; these latter he called *exciting rays*; to the first he gave the name of *continuing rays*.

M. Ed. Becquerel made his experiments on photogenic papers, and added that he had observed the same effects on the iodized silver plate.

Dr. Draper of New York published in the Philosophical Magazine for November 1842, some remarks on a class of rays which he supposed to exist in the light of the brilliant sun of Virginia, and which had the property, when separated, of entirely suspending the action of the diffused light from the sky; these antagonistic rays extended from the blue to the extremity of the red, and appeared to be almost as active in preventing the decomposition of the iodide of silver as the blue rays were in producing it.

In January 1845 a memoir was read by me at the Society of Arts, London, in a part of which I recommended opticians to construct object-glasses in which they should particularly correct the chromatic aberration of the long photogenic space of the solar spectrum, even at the cost of the achromatism of the less refrangible rays. This, however, had been already indicated, without my being aware of it at the time, by Sir J. Herschel; but I added that the greater separation of the visual and photogenic focus which might result from such a combination, according to the quality

of the glass employed, would be an advantage, by dispersing, at the focus or on the plate, beyond the photogenic lines, the red, orange or yellow rays; for the reason, that if they were brought to the same point they would tend to neutralize and destroy the effect of the photogenic rays.

In October 1846, M. Lerebours announced to the Paris Academy of Sciences that the red rays prevented the action of the photogenic rays; this announcement induced Messrs. Foucault and Fizeau to publish immediately similar results, which they had previously consigned to the Academy in a sealed memoir, bearing date May 1846.

These communications of Messrs. Lerebours, Foucault and Fizeau, led Dr. Draper to write a letter, published in the Philosophical Magazine of February last, repeating his observations on the spectrum of Virginia, adding several other analogous facts confirming the theory of a protecting and even destroying action exercised by the least refrangible rays. Dr. Draper, in the same letter, said that the rays which protect the plate from ordinary photogenic action are themselves capable, when isolated, of producing a peculiar photogenic effect.

Soon after the publication of M. Ed. Becquerel's memoir, M. Gaudin made some analogous researches on the Daguerreotype plate; and he succeeded in developing an image as perfect as that produced by mercury, by submitting the plate, when taken from the camera obscura, to the action of light alone under a yellow glass, and without any subsequent exposure to mercury.

This curious discovery gave some hope that, from the supposed continuing action of the red and yellow glasses, by submitting the plate alternately, or simultaneously, to the action of the mercury and of these glasses, an accelerated development of the image would result; but all the researches made to arrive at this point have been fruitless; and, until the present time, the labours of Messrs. Becquerel and Gaudin have received no satisfactory explanation or useful application.

My own experiments, which are the object of this memoir, seem to prove that M. Ed. Becquerel was mistaken as regards the Daguerreotype plate, in so far as he attributed to the red, orange and yellow glasses a continuing action of the effect of the photogenic rays.

In the Daguerreotype, when we speak of the *photogenic effect*, we cannot understand any other than that which gives to the surface an affinity for mercurial vapour.

In the case of photogenic papers, it is true that the red, orange, and yellow rays render the parts previously affected by the photogenic rays black or of a darker colour. It is the same with the Daguerreotype plate, which after it has been feebly impressed, darkens rapidly to a violet colour under the radiation of a red or yellow glass. This is the only continuing effect I have observed, and this effect is not *continuing* in a Daguerreotype sense, it has no relation to the property of attracting the mercurial vapour; on the contrary, it will be seen from the experiments which I am about to describe, that the radiations of red, orange and yellow glasses entirely destroy this property. There exists then a certain analogy between the action of the

red, orange and yellow glasses upon the photogenic papers and the Daguerreotype plate; and this continuing action is probably due to the distinct photogenic action possessed by these rays, as I am able to prove by facts of a very positive nature.

These two photogenic actions result from two different principles, nevertheless producing similar effects, as to the colour obtained, on the iodide, bromide or chloride of silver, whether it be found isolated, as is the case on the photogenic paper, or it be found in the presence of metallic silver, as happens upon the Daguerreotype plate; but they produce quite an opposite effect upon the silver plate, whatever may be the colour previously given to the surface by these two radiations, endowing it with a property, the one of attracting, the other of repelling the mercurial vapours. We must take care not to confound these two results; we can conceive two different actions giving the same colour to the iodide of silver, and we can also conceive that these two actions may be endowed with contrary properties as regards the fixation of mercurial vapour.

The facts pointed out by M. Gaudin are the results of an action which does not belong to the Daguerreotype, since they are manifested without the aid of mercury; for we must not lose sight of the fact, that the production of the Daguerreotype image is due only to the affinity for mercury of the parts previously affected by the photogenic rays. It does not then follow from the production of an image without mercury, by crystallization or some peculiar arrangement of the molecules, that the red, orange, and yellow rays exert a continuing action analogous to that which determines the fixation of mercurial vapour.

The experiments of Sir J. Herschel, of Dr. Draper, of M. Lerebours, and of Messrs. Foucault and Fizeau, to prove the protective and destructive action of the red rays, were made with the prism.

These philosophers have thus operated with the isolated rays in all their natural purity, and after them it would have been useless to seek to confirm or to contradict experiments so ably conducted and so conclusive.

Sir J. Herschel, in a memoir published in the Philosophical Magazine for February 1842, approves only of experiments made by means of the prism, as they are less subject to error from the foreign rays, which the coloured glasses never entirely exclude. This observation is perfectly just in theory, but in practice, in the particular case of the photogenic power of different rays and of their different actions, it will be found that these phenomena can be studied with greater facility by using coloured glasses, and that the feeble quantity of foreign rays which they admit, far from interfering with the deductions of the experimenter, serve only to confirm and to render them more conclusive. We shall presently see that these foreign rays are completely neutralized in this class of experiments, and it would have been unfortunate not to have added these tests to those of the solar spectrum, since by the aid of coloured glasses I have been enabled, not only to confirm certain properties of the pure spectrum, but also to discover some others which had escaped my predecessors.

Having examined with a prism the light transmitted through the glasses used in these experiments, I found that the red absorbs two-thirds of the prismatic spectrum, from the space covered by the green to the extremity of the violet, leaving the red, orange, and a little yellow, followed by a very slight trace of green. The orange glass gave more yellow, the green being more decided. The light yellow glass intercepted the half of the spectrum; the red was less intense than in the preceding; the yellow occupied two-thirds of its total length, and the green became very distinct; but as far as my sight allowed me to judge, I could not discover any portion of blue in either case: certainly in the spectrum of the red glass there was not the least trace of it.

I will now detail the series of observations I have made upon light transmitted through certain media—the vapours of the atmosphere, and red, orange, and yellow glasses. These experiments have brought forth some results which will I hope contribute to lay the foundation of a more complete theory of the photographic phenomena.

Having noticed, one densely foggy day, that the disc of the sun was of a deep red colour, I directed my apparatus towards it. After ten seconds of exposure I put the prepared plate in the mercury box, and I obtained a round image perfectly black. The sun had produced no photogenic effect. In another experiment I left the plate operating for twenty minutes. The sun had passed over a certain space of the plate, and there resulted an image seven or eight times the sun's diameter in length: it was black throughout, so that it was evident, wherever the red disc of the sun had passed, not only was there a want of photogenic action, but the red rays had destroyed the effect produced previous to the sun's passage. I repeated these experiments during several days successively, operating with a sun of different tints of red and yellow. These different tints produced nearly the same effect: wherever the sun had passed there existed a black band.

I then operated in a different manner: not content with the slow motion of the sun, I moved the camera obscura from right to left, and *vice versâ*, lowering it each time by means of a screw. In this manner the sun passed rapidly over five or six zones of the plate. Its passage was marked by long black bands of the diameter of the sun, whilst the intervals were white. It was then evident that the red and yellow rays, which alone were capable of piercing the fog, had destroyed the action produced by the little photogenic light which came from the zenith.

I then operated with coloured glasses. After exposing a plate covered with a piece of black lace to daylight, I covered one half, and submitted the other to the radiation of a red glass: the mercury developed an image of the lace on the part which had been acted on only by the white light; the other, which had afterwards received the action of the red rays, remained black. The red glass had destroyed the photogenic effect in the same manner as it had been done by the red light of the sun.

I made the same experiment with orange and yellow glasses, and obtained analogous results, but in different times.

Then, having exposed a plate to daylight, I subsequently covered it with a piece of black lace, and exposed it again under a red glass: this produced a negative image. The red had destroyed the effect of the white light in the intervals of the lace, the threads of which preventing the action of the red glass, produced a white image upon a black ground. In operating in this manner upon one-half of the plate, exposing the other half covered only by the same lace to the light of the day, I obtained by the first a negative, and by the second a positive image. The orange and yellow glasses give the same result, paying regard to the difference of time in their respective actions.

All these experiments prove what has been already observed by others before me, but in a different manner, that the red, orange and yellow rays destroy the effect of the photogenic light, whether these rays be produced by the prism or by the action of coloured media; but, I believe, it has not been observed by any one before me, that after the destruction of the photogenic effect the plate is perfectly restored to its former sensitiveness to white light.

After exposing a plate to daylight, and then submitting it to the destructive action of red, orange or yellow rays, it will be found again sensitive to the same white light.

I have obtained plates which present an equal and uniform image, although the one-half had been exposed to light, and then restored by the red, orange or yellow glass, while the other half had received only the single and final radiation. We may then expose a plate to light, destroy this effect by the action of red or yellow glass, which renders it again sensitive; then expose it again to light, destroy this second effect by the same coloured glass, and so on for many times, without changing the properties of the surface; so that if we stop after any of the exposures to white light, the plate will receive mercury; but if we stop after any of the exposures to red, orange or yellow light, we shall obtain no fixation of mercurial vapour.

Having exposed a plate to the two actions alternately, first, once upon one zone, twice upon another, and so on until the last zone had been exposed and destroyed six times, I covered the plate with a piece of black lace or an engraving, finally exposing the whole to white light; the result was an equal deposit of mercury upon the whole surface of the plate. The impression of the lace or engraving seemed to be the result of a single exposition to light, as would have been the case with a normal plate; therefore the action of the red, orange, or yellow glass upon a plate previously affected by light, produces the same effect as a fresh exposure to the vapours of iodine or bromine, when we wish to restore the plate to its first sensitiveness.

This restoring property of the coloured glasses may be of great use in the Daguerreotype manipulation. Instead of preparing the plates in the dark, it may be done with impunity in the open light. To give sensitiveness, we have only to place the plate for some minutes under a red glass before putting it in the camera obscura. The frame or box used to hold the plate, if furnished with a red glass at the bottom,

will serve for this restoration. I have obtained in this manner images equal in effect to those produced on plates prepared in the dark.

This possibility of preparing plates in open day offers a great advantage to those who wish to take views or pictures abroad, and who cannot conveniently obtain a dark room. Again, in the case of a plate which has been left too long in the camera obscura, or accidentally exposed to the light, instead of rejecting it, we can restore its sensitiveness by placing it under a red glass. There is still another useful application of this property: if after one or two minutes' exposure to the mercury we perceive the image is too rapidly developing, or presenting signs of solarization, which a practised eye discovers before it is too much advanced, we have only to stop this accumulation of mercury by exposing the plate for a few seconds to the red light, and again place it in the mercury box, to complete the modifications, which give the image all its tones and the most favourable tint. In truth, we may complete all the operations of the Daguerreotype in the open air, in the middle of a field if necessary. We can introduce the plate into the mercury box, in the same manner that we did in the camera obscura, by means of the same frame and red glass, which also serves to protect it when we take it from the mercury to rapidly view its development. I say rapidly, for if we expose it too long to the red light, the photogenic effect will be neutralized. We shall presently see that the time required to observe the state of the image is not sufficient to affect its affinity for mercury, if it be found requisite to replace it in the mercury box. The exposure under red glass necessary to destroy the effect produced by white light, must be a hundred times longer than has been the exposure to white light, that of the orange glass fifty times, and that of the yellow glass only ten times; thus a plate exposed to white light for a second will be restored to its former sensitiveness in ten seconds by the yellow glass, in fifty by the orange, and in a hundred by the red. As soon as the sensitiveness of the plate affected by white light is restored by the coloured glasses, it may be affected again by the photogenic light. It is not even necessary that the restoration should be complete; at each degree of restoration the plate is capable of receiving an accumulation of photogenic effect. If the red rays have not acted more than fifty times longer than the daylight, only half of the effect will be destroyed; if twenty-five times longer, one-fourth; and so on in proportion.

Besides the destructive action of the red, orange and yellow glasses, these same radiations are endowed with a photogenic power, that is to say, they have, like the blue and violet rays, the power of causing the fixation of mercurial vapour. Therefore these radiations are endowed with two contrary actions; the one destructive of the effect of the photogenic light, and the other analogous to the effect of this light.

If the red, orange and yellow radiations of the prism had not also the power of operating photogenically, it might be supposed that this action of the coloured glasses was due to some of the most refrangible rays transmitted by these coloured media. But this cannot be; for if the photogenic action of the red, orange and yel-

low rays were the same as that of the more refrangible rays, it could never develope itself under the destructive action which the same glasses carry with them.

But there is yet more; each ray of the spectrum has its own photogenic action, and they are in this respect independent of each other, and of a different kind; so that the one cannot continue the effect commenced by the other, whether it be for the production or for the destruction of the photogenic effect. I would again observe, whenever I speak of a photogenic effect, I mean that which gives to the Daguerreotype plate the property of attracting the vapours of mercury.

If we expose a plate covered by an engraving to the red light 5000 times longer than is required to produce an effect by white light, we obtain by the fixation of mercury a feeble image, the lights of which are of a grey tone. I could never go beyond this feeble image, which appeared to be the maximum of effect for the red glass. It is impossible to attribute this effect to some feeble quantity of rays, properly called photogenic, passing through the coloured glasses, for we have seen that the blue and violet rays cannot operate under the destructive action of the red rays; this fact proves then evidently, that if the red radiation has a photogenic effect, it cannot be due to the same principle which produces the photogenic effect of the rays situated at the other extremity of the spectrum. The yellow glass has also a peculiar photogenic action of its own, it is a hundred times slower than that of white light, whilst its destructive action is not more than ten times as slow. We can obtain by the photogenic action of the yellow glass an image almost identical, as to force and colour, with an image produced by daylight; with this difference, that the excess of action does not give the blue solarization which we observe upon plates strongly affected by daylight.

The different nature of the photogenic action of red, orange and yellow glasses, from that of the daylight, is also proved by the fact, that the photogenic action produced by these coloured glasses cannot be destroyed by their own reversing action, although the red will destroy the photogenic action of the yellow, and both of these will destroy the action of daylight.

The double property of producing and destroying a photogenic effect is manifested upon a specimen which offers on one-half of the plate a negative image, and upon the other half a positive image, produced at the same time by the same radiation. The length of time necessary to operate with the red glass has not allowed me to obtain a good impression, but I have succeeded perfectly with the yellow glass. The experiment is especially beautiful, and has been thus made:—

I exposed one-half of the plate to daylight for one second, keeping the other half in the dark. The entire plate was then covered with an engraving and exposed under a light yellow glass during ten seconds for the part previously affected by white light, and during a hundred seconds for that which had been kept in the dark. The yellow glass destroyed on the first half the effect of the daylight wherever the plate was not protected by the black lines of the engraving, and the parts only which

under these lines had been protected from the destructive action, received the mercury, producing a negative image; while the same radiation of the yellow glass had operated photogenically upon the other half, developing a positive image by the fixation of mercury upon the parts corresponding to the lights of the engraving.

Having exposed a plate with an engraving under the red glass for sixty minutes, I replaced the red by a yellow glass, without the engraving; after exposing the half of this plate for five minutes under this yellow glass, the other half being kept in the dark, the mercury produced a negative image on the half exposed to yellow light, while the other gave no trace of either positive or negative action. This result can only be explained in the following manner:—

First. That sixty seconds had not sufficed for the apparent action of the red upon the half not exposed to the following radiation of the yellow glass.

Secondly. That nevertheless there had been the commencement of an action upon which the yellow glass had to exercise its destructive action.

Thirdly. That while the yellow glass was occupied in destroying the photogenic action of the red glass, restoring the surface to its primitive state, it was exercising a photogenic action upon the parts protected by the engraving from the red rays, and in five minutes this photogenic action of the yellow glass had produced a negative image by operating upon the shadows of the drawing.

It results from the experiments I have described, that the solar radiation, when modified by coloured media, is in the Daguerreotype process endowed with several different photogenic actions, corresponding with various rays of the spectrum.

The various photogenic actions of the modified solar radiation have distinct characters; each of these modifications is endowed with a photogenic power peculiar to itself, and which gives an affinity for mercurial vapour to the Daguerreotype plate. These various actions are so different, that we cannot mix them artificially to assist each other, as they are antagonistic. The effect commenced by the blue rays is destroyed by the red and yellow; that which was produced by the red is destroyed by the yellow; the effect of the yellow rays is destroyed by the red; and the effect of the two latter is destroyed by the blue; each radiation destroys the effect of the others. Thus it appears that each radiation changes the state of the surface, and each change produces the sensitiveness to mercurial vapour when it does not exist, and destroys this sensitiveness when it does exist.

The alternate change of the state of the plate by these various radiations seems to prove that the chemical compound remains always the same under these different influences; that there is no separation or disengagement of the constituent elements.

If the blue radiation or white light liberates iodine or bromine, these elements would evaporate or combine with the silver surface immediately beneath. If we take the first idea, how comes it that the red radiation re-establishes the compound in its primitive proportions; and, in the second case, how does it happen that these rays are capable of decomposing the surface beneath, liberating the iodine or bromine, and

then combining them again with the upper surface? It is impossible to admit that the red radiation is endowed at the same time with the property of separating and the property of reuniting the same elements. We must then attribute it to a particular force—electricity perhaps, which might accompany each radiation, and which, under the influence of the one, would act positively, and negatively under the other, without changing the chemical compound. In one case this influence would give the affinity for mercury, and in the other destroy it.

At all events, we must look for another explanation of the phenomenon than the one which has hitherto been received, viz. the decomposition of the iodide of silver by the action of light. It is true that light decomposes iodide of silver, forming a subiodide, but this seems to require a longer time than that during which the surface is endowed with the property of attracting the vapours of mercury. In fact, the last property is communicated nearly instantaneously, which is not the case for the decomposition of the iodide by the action of light.

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TEMMINCK (C. J.) Coup d'œil Général sur les Possessions Neerlandaises dans l'Inde Archipélagique. Tome I. 8vo. *Leide* 1846.	J. E. Gray, Esq.
ULRICKS (H. N.) Topography of the Harbours of Athens. 8vo. *London* 1847.	The Author.
VALENTINE (G.) und FELLENBERG (L. R.) Ueber die bei der Consolidation des Faserstoffes stattfindenden Veränderungen der elementaranalytischen Bestandtheile desselben. 8vo.	The Authors.
VIETA (F.) Canon Mathematicvs sev, ad Triangvla cum Adpendicibus. fol. *Lvtetiæ* 1579.	A. De Morgan, Esq.
WEBSTER (T.) The Principles of Hydrostatics. 8vo. *London* 1847.	The Author.
WHITE (A.) A Treatise on the Plague. 8vo. *London* 1846.	The Author.
WICKSTEED (T.) Report on East London Water-works. 4to. *London* 1847.	The Author.
WILLICH (C.) Tables for valuing Advowsons for 1847.	The Author.
WILSON (E.) On the Management of the Skin. 8vo. *London* 1847.	The Author.
——— On Diseases of the Skin. 8vo. *London* 1847.	———
——— The Anatomist's Vade Mecum. 8vo. *London* 1847.	———
——— Account of a Horn developed from the Human Skin. 8vo. *London* 1844.	———
——— An Account of the *Trichocephalus affinis*. 8vo. *London* 1846.	———
——— The History of the Middlesex Hospital. 8vo. *London* 1845.	———
——— On the Classification, Structure and Development of the *Echinococcus Hominis*. 8vo. *London* 1844.	———
ZANTEDESCHI (Prof.) Ricerche Fisico-Chimico-Fisiologiche sulla luce. 8vo. *Venezia* 1846.	The Author.

THE ROYAL SOCIETY.

30TH NOVEMBER 1847.

THE ROYAL SOCIETY. Nov. 30, 1847.

Her Sacred Majesty QUEEN VICTORIA, Patron.

Date of Election.	
1840. Apr. 30.	HIS ROYAL HIGHNESS, PRINCE ALBERT OF SAXE-COBURG AND GOTHA.
1828. Apr. 24.	HIS ROYAL HIGHNESS, ERNEST AUGUSTUS, DUKE OF CUMBERLAND, KING OF HANOVER.
1817. May 22.	HIS IMPERIAL MAJESTY NICHOLAS, EMPEROR OF ALL THE RUSSIAS.
1842. Jan. 20.	HIS MAJESTY FREDERICK WILLIAM IV., KING OF PRUSSIA.
1816. ——	HIS MAJESTY LEOPOLD, KING OF THE BELGIANS.
1822. June 6.	HIS MAJESTY CHRISTIAN VIII., KING OF DENMARK, D.C.L.
1844. June 13.	HIS MAJESTY FREDERICK, KING OF SAXONY.
1826. Dec. 21.	HIS MAJESTY OSCAR I., KING OF SWEDEN AND NORWAY.
1838. May 24.	HIS IMPERIAL AND ROYAL HIGHNESS, LEOPOLD THE SECOND, GRAND DUKE OF TUSCANY.
1816. Feb. 8.	HIS IMPERIAL HIGHNESS, THE ARCHDUKE JOHN OF AUSTRIA.
1816. Feb. 8.	HIS IMPERIAL HIGHNESS, THE ARCHDUKE LOUIS OF AUSTRIA.
1802. Mar. 4.	HIS IMPERIAL HIGHNESS, THE ARCHDUKE MAXIMILIAN OF AUSTRIA.

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OF

THE ROYAL SOCIETY.

THE MARQUIS OF NORTHAMPTON.—PRESIDENT.

GEORGE RENNIE, ESQ., V.P. AND TREASURER.	JOHN P. GASSIOT, ESQ.
PETER MARK ROGET, M.D.—SECRETARY.	THOMAS GRAHAM, ESQ., M.A., V.P.
S. HUNTER CHRISTIE, ESQ., M.A.—SECRETARY.	JOHN THOMAS GRAVES, ESQ., M.A.
LIEUT.-COL. EDW. SABINE, R.A., FOR. SEC.	SIR JOHN F. W. HERSCHEL, BT., M.A., V.P.
THOMAS BELL, ESQ.	WILLIAM HOPKINS, ESQ., M.A.
ROBERT BROWN, ESQ., D.C.L.	SIR ROBERT H. INGLIS, BART., D.C.L., V.P.
SIR JAMES CLARK, BART., M.D.	CHARLES LYELL, ESQ., M.A.
SAMUEL COOPER, ESQ.	THE DUKE OF NORTHUMBERLAND., V.P.
SIR HENRY DE LA BECHE, V.P.	GEORGE RICHARDSON PORTER, ESQ.
EDWARD FORBES, ESQ.	LIEUT.-COL. SYKES, V.P.

*** *This Council will continue till November* 30, 1848.

Omissions having occasionally occurred in the Annual List of Deceased Fellows, as announced from the Chair at the Anniversary Meeting of the Royal Society, any information on that subject, as also Notice of Changes of Residence, will be received by the Assistant Secretary, Charles Richard Weld, Esq.

SCIENTIFIC COMMITTEES OF THE ROYAL SOCIETY.

FOR THE SESSION OF 1847–1848.

1. MATHEMATICS.

Very Rev. The DEAN OF ELY, Chairman;
MR. CHRISTIE, Secretary.

MR. AIRY.	MR. HOPKINS.
MR. GALLOWAY.	REV. P. KELLAND.
MR. GOMPERTZ.	REV. DR. LLOYD.
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2. ASTRONOMY.

MR. AIRY, Chairman;
REV. G. FISHER, Secretary.

SIR THOMAS BRISBANE.	SIR J. CLARK ROSS, R.N.
MR. DOLLOND.	THE EARL OF ROSSE.
Very Rev. The DEAN OF ELY.	REV. R. SHEEPSHANKS.
MR. GALLOWAY.	CAPT. SMYTH, R.N.
SIR J. F. W. HERSCHEL, Bart.	LIEUT. STRATFORD, R.N.
SIR J. W. LUBBOCK, Bart.	LORD WROTTESLEY.

3. PHYSICS, including METEOROLOGY.

SIR J. F. W. HERSCHEL, Bart., Chairman;
MR. WHEATSTONE, Secretary.

MR. AIRY.	MR. LUKE HOWARD.
MR. BARLOW.	REV. P. KELLAND.
ADMIRAL BEAUFORT.	REV. DR. LLOYD.
SIR DAVID BREWSTER.	SIR J. W. LUBBOCK, Bart.
MR. CHRISTIE.	MR. MILLER.
MAJOR-GENERAL COLBY.	MR. JOHN PHILLIPS.
DR. DAUBENY.	REV. B. POWELL.
Very Rev. The DEAN OF ELY.	SIR J. CLARK ROSS, R.N.
MR. FARADAY.	LIEUT.-COL. SABINE.
MR. J. D. FORBES.	LIEUT.-COL. SYKES.
MR. GASSIOT.	MR. H. FOX TALBOT.
MR. GROVE.	REV. R. WALKER.
SIR W. SNOW HARRIS.	REV. W. WHEWELL.
MR. HOPKINS.	REV. R. WILLIS.

4. CHEMISTRY.

MR. R. PHILLIPS, Chairman;
MR. GRAHAM, Secretary.

MR. CHILDREN.	MR. JOHNSTON.
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DR. DAUBENY.	MR. PEPYS.
MR. FARADAY.	DR. PROUT.
MR. POWNES.	MR. E. SOLLY.
MR. HATCHETT.	DR. THOMAS THOMSON.

5. MINERALOGY AND GEOLOGY.

DR. FITTON, Chairman;
DR. MANTELL, Secretary.

MR. H. J. BROOKE.	MR. LYELL.
MR. DARWIN.	MR. MILLER.
SIR H. T. DE LA BECHE.	SIR R. I. MURCHISON.
MR. GREENOUGH.	MR. JOHN PHILLIPS.
MR. HORNER.	REV. A. SEDGWICK.
MR. JAMESON.	MR. TAYLOR.

Very Rev. The DEAN OF WESTMINSTER.

6. BOTANY AND VEGETABLE PHYSIOLOGY.

DR. WALLICH, Chairman;
DR. ROYLE, Secretary.

MR. BENNETT.	DR. HORSFIELD.
DR. DAUBENY.	DR. LINDLEY.
MR. DILLWYN.	DR. PEREIRA.
MR. E. FORBES.	MR. R. H. SOLLY.
MR. FORSTER.	MR. H. FOX TALBOT.
SIR W. J. HOOKER, K.H.	MR. DAWSON TURNER.

7. ZOOLOGY AND ANIMAL PHYSIOLOGY.

SIR B. C. BRODIE, Bart., Chairman;
MR. BELL, Secretary.

DR. MARTIN BARRY.	MR. KIERNAN.
MR. BISHOP.	MR. LAWRENCE.
MR. BOWMAN.	MR. OWEN.
DR. CLARK.	DR. PRICHARD.
MR. CLIFT.	DR. REES.
MR. E. FORBES.	SIR JOHN RICHARDSON.
MR. J. E. GRAY.	DR. ROGET.
MR. GREEN.	DR. ROUPELL.
MR. T. R. JONES.	DR. SHARPEY.

DR. TODD.

By a Resolution of the Council (April 11th, 1839), the President, Treasurer, and Secretaries are, *ex-officio*, Members of all Committees.

FELLOWS OF THE SOCIETY.

NOVEMBER 30, 1847.

(C) prefixed to a name indicates that the Member has received a Copley Medal.
(R) ... ... Royal Medal.
(Rm) ... ... Rumford Medal.
(P) ... ... has contributed a Paper to the Philosophical Transactions.
(*) ... ... is liable to an annual payment of £2 12s.
(†) ... ... is liable to an annual payment of £4.

Date of Election.		
1808. Apr. 28.		Aberdeen, George, Earl of, K.T. Trust. Brit. Mus. F.L.S. *Argyll-house.*
1847. Jan. 21.		Acland, Henry Wentworth Dyke, M.D. *Oxford.*
1839. June 20.		Acland, Sir Thomas Dyke, Bart., F.G.S. *Killerton-park, Devon.*
1845. June 5.		† Adair, Robert Shafto, Esq. 7 *Audley-square.*
1834. Apr. 10.		Adare, Edwin, Viscount, F.R.A.S. *Adare-abbey, Limerick; Dunraven-castle, Glamorganshire.*
1846. Jan. 29.	P.	† Addison, William, M.D., F.L.S. *Great Malvern.*
1832. June 7.		† Agar, Hon. George Charles, M.A. *University Club.*
1836. Jan. 21.	C.R. P.	Airy, George Biddell, Esq., M.A., D.C.L., Astronomer Royal, V.P.R.A.S.—Hon. Mem. R.S.E. R.I.A. R.I.S.W. F.C.P.S., Corresp. Mem. National Inst. Washington U.S. Inst. Reg. Sc. Paris., Acadd. Imp. Sc. Petrop., et Reg. Sc. Berol. Corresp., Acadd. Sc. Lit. Panorm., Holm. et Monach. Socc. Reg., Sc. Hafn., Acad. Amer. Art. et Sc. Bost. Socius. *The Royal Observatory, Greenwich.*
1841. June 17.		† Alderson, James, M.D. Coll. Reg. Med. Socius. 36 *Charles-street, Berkeley-square.*
1847. Apr. 22.		† Alexander, Henry, Esq. 6 *Cork-street.*
1844. Apr. 18.		† Allen, William, Esq., Capt. R.N. *Athenæum Club.*
1824. Jan. 22.		Amyot, Thomas, Esq. Treas. S.A. Hon. M.R.I.A. Soc. Reg. Antiq. Septen. Hafn. Socius. 13 *James-street, Westminster.*
1821. Mar. 29.		Andrew, James, LL.D.
1840. Jan. 30.		† Annesley, Sir James. *H* 6, *Albany.*
1834. Apr. 10.		Ansell, Charles, Esq., F.S.A. *Tottenham.*
1844. Jan. 11.		† Ansted, David Thomas, Esq., M.A., F.G.S. F.L.S. F.C.P.S., Professor of Geology King's College, London. 36 *Gloucester Road, Hyde Park-gardens.*
1840. Nov. 26.		† Archibald, Charles Dickson, Esq., F.S.A., F.G S. M.R.I. *A* 3, *York-terrace, Regent's-park; and Rutland-hall, Lancashire.*
1846. May 7.		† Armstrong, William George, Esq. *Newcastle-upon-Tyne.*
1843. May 25.		† Arnott, James Moncrieff, Esq. 2 *New Burlington-street.*
1838. Jan. 25.		† Arnott, Neil, M.D. 38 *Bedford-square.*
1830. Mar. 18.		Audubon, John James, Esq., F.L.S.
1840. May 7.		† Auldjo, John, Esq. *Noel-house, Kensington.*

Date of Election.		
1837. June 1.		† Ayrton, William, Esq., F.S.A. 39 *Dorset-square.*
1816. Mar. 14.	P.	Babbage, Charles, Esq., M.A. F.R.S.E. Hon. M.R.I.A. F.R.A.S. M.C.P.S. Inst. Reg. Sc. Paris. Corresp. Acadd. Reg. Sc. Masil., Hafn., et Divion. ex intim.: Acad. Amer. Art. et Sc. Bost., Socc. Reg. Œcon. Boruss., et Phys. Hist. Nat. Genev., Socius.—Acadd. Imp. et Reg. Petrop. Pat., Georg. Florent., Brux., Neap., Mut., Lync. Rom., Corresp. Societ. Philomat. Paris. 1 *Dorset-street, Manchester-square.*
1816. May 23.		* Baber, Rev. Henry Hervey, M.A. M.R.S.L. Acad. Reg. Sc. Monach. Socius. *Stretham, Cambridgeshire.*
1828. Mar. 13.		Babington, Benjamin Guy, M.D. Coll. Reg. Med. Socius. 31 *George-street, Hanover-square.*
1847. Jan. 7.		† Back, Sir George, Knt., Capt. R.N. *Gloucester-place, Portman-square.*
1836. Feb. 11.		† Baillie, David, Esq. 14 *Belgrave-square.*
1842. Jan. 13.		† Baily, Edward Hodges, Esq., R.A. 10 *Percy-street, Tottenham-court-road.*
1847. Apr. 15.		† Baly, William, M.D. Coll. Reg. Med. Socius. 28 *Spring-gardens.*
1845. June 5.		† Bandon, Right Hon. James Earl of. 6 *Hyde Park-terrace; and Castle Bernard, Bandon, Ireland.*
1841. June 10.		† Baring, Sir Thomas, Bart. 21 *Devonshire-place; and Stratton-park, Winchester.*
1834. Dec. 18.		Barlow, Rev. John, M.A. F.L.S., Secretary to the Royal Institution. 5 *Berkeley-street, Piccadilly.*
1823. May 29.	C.P.	Barlow, Peter, Esq., F.R.A.S. Hon. M.C.P.S. Acadd. Imp. Sc. Petrop. Amer. Art. et Sc. Bost. Socius.—Instit. Reg. Sc. Paris., et Acad. Reg. Sc. Brux. Corresp. *Royal Military Academy, Woolwich.*
1845. Nov. 20.	P.	Barlow, Peter William, Esq. 8 *Elliot-place, Blackheath.*
1809. Mar. 9.		Barnwell, Charles Frederick, Esq., M.A. F.S.A. 44 *Woburn-place, Russell-square.*
1823. Feb. 13.		Baron, John, M.D. *Cheltennam.*
1805. July 4.		Barrow, Sir John, Bart., F.L.S. 7 *New-street, Spring-gardens.*
1844. Dec. 12.		Barrow, John, Esq. 7 *New-street, Spring-gardens.*
1840. Feb. 13.	R.P.	Barry, Martin, M.D. F.R.S.E. Coll. Reg. Med. Edin. Socius. *Edinburgh.*
1838. Feb. 8.		† Bateman, James, Esq., F.L.S. *Knypersley-hall, Staffordshire.*
1822. Feb. 28.		Batty, Lieut.-Colonel Robert. 1 *Ridgmount-place, Amphill-square.*
1827. Nov. 15.		Beamish, Major North Ludlow, K.H. *Windham Club, St. James's-square.*
1836. Mar. 24.		Beamish, Richard, Esq.
1814. June 30.		Beaufort, Francis, Rear Admiral, F.G.S. F.R.A.S. Instit. Sc. Paris. Corresp. *Admiralty; and* 11 *Gloucester-place, Portman-square.*
1815. Dec. 14.		Beaufoy, Henry, Esq., F.L.S. *South Lambeth.*
1835. June 4.		† Beaumont, Edward Blackett, Esq., F.R.A.S. 144 *Piccadilly; and Finningly-park, near Bawtry, Yorkshire.*
1824. Dec. 23.		† Beechey, Frederick William, Esq., Capt. R.N., F.R.A.S. 8 *Westbourne-crescent, Hyde-park.*
1835. Feb. 5.		† Beetham, Albert William, Esq., F.S.A. 3 *Serjeant's-inn, Fleet-street; and Ropehill-lodge, Bolder, near Lymington, Hants.*
1828. Jan. 10.	P.	Bell, Thomas, Esq., F.L.S. F.G.S. Socc. Hist. Nat. et Philomath. Paris, Acad. Sc. Philad. et Soc. Hist. Nat. Bost. Corresp. Prof. of Zoology, King's College, London. 17 *New Broad-street; and Selborne.*

Date of Election.		
1834. Dec. 18.		† Bellamy, Rev. James William, B.D. *Sellinge Vicarage, Ashford, Kent.*
1841. Dec. 16.		† Bennett, John Joseph, Esq., Sec. L.S. *British Museum.*
1831. May 5.		Beverly, Charles James, Esq., F.L.S. 1 *Hackney-grove, Hackney.*
1822. Feb. 7.		Bexley, Nicholas Lord, M.A. F.S.A. M.R.S.L. 31 *Great George-street; and Foots-Cray-place, Kent.*
1827. May 10.		Bicheno, James Ebenezer, Esq., F.L.S. F.G.S. Colonial Secretary, Van Diemen's Land. *Hobarton.*
1844. June 6.		† Billing, Archibald, M.D. A.M. F.G.S., Coll. Reg. Med. Socius, Soc. Med. Nov.-Ebor. Socius, Soc. Med.-Phys. Florent. et Dresd. Med.-Chir. Brux. Corresp. 6 *Grosvenor Gate, Park-lane.*
1846. Jan. 22.	P.	Bird, Golding, A.M. M.D. Coll. Reg. Med. Socius. Assistant Physician and Lecturer on Materia Medica, Guy's Hospital. 19 *Myddelton-square.*
1844. May 9.	P.	† Bishop, John, Esq. 38 *Bernard-street, Russell-square.*
1830. Mar. 4.		Blake, Capt. Benjamin, F.G.S. F.R.A.S. *India.*
1843 Apr. 6.		Blake, Henry Wollaston, Esq. *Soho, Birmingham*; and 62 *Portland-place.*
1807. May 14.		Blake, William, Esq., M.A. F.G.S. 62 *Portland-place; and Danesbury, near Welwyn, Hertfordshire.*
1831. Jan. 20.		Blake, William John, Esq. 62 *Portland-place.*
1841. Jan. 21.		† Blakiston, Peyton, M.D. Coll. Reg. Med. Socius. *Birmingham.*
1816. Feb. 8.		Bland, Michael, Esq., F.S.A. F.G.S. *St. Leonard's, Hastings.*
1821. Apr. 12.		Bland, Rev. Miles, D.D. F.S.A. F.R.A.S. M.R.S.L. *Lilley Rectory, near Luton.*
1841. June 10.		† Blore, Edward, Esq. 4 *Manchester-square.*
1837. May 11.		Boase, Henry, M.D. F.G.S. *Claverhouse, near Dundee.*
1840. Mar. 5.		† Boileau, John Theophilus, Esq. Major E.I.C.S. *India.*
1843. June 1.		Boileau, Sir John, Bart. 20 *Upper Brook-street*; and *Ketteringham-hall, Norfolk.*
1840. June 18.		† Bonner, Col. John George, E.I.C.S. 11 *A, Great Cumberland-street, Hyde-park.*
1834. Apr. 10.		† Booth, Sir Felix, Bart. 43 *Portland-place; and Hendon, Middlesex.*
1846. Jan. 22.		† Booth, Rev. James, LL.D. M.R.I.A. *Everton, Liverpool.*
1835. June 4.		† Borrer, William, Esq., F.L.S. *Henfield, Sussex.*
1829. June 4.		Bosworth, Rev. Joseph, LL.D. F.S.A. M.R.I.A. Soc. Reg. Antiq. Septen. Hafn. Corresp., Socc. Reg. Sc. Norv., Dronth., et Gothob. Socius. 9 *Southampton-street, Bloomsbury; and Etwell, Uttoxeter, Staffordshire.*
1839. Jan. 17.		Botfield, Beriah, Esq., F.S.A. F.R.A.S. F.G.S. F.L.S. *Norton-hall, Northamptonshire.*
1814. May 5.	P.	Boughton, Sir William Edward Rouse, Bart. *Downton-hall, Ludlow.*
1842. Nov. 17.	R.P.	Bowerbank, James Scott, Esq., F.G.S. 3 *Highbury-grove.*
1841. Apr. 22.	C.P.	Bowman, William, Esq. 14 *Golden-square.*
1809. Apr. 13.		Brande, William Thomas, Esq., Professor of Chemistry in the Royal Institution, F.R.S.E. *Royal Mint, Tower-hill.*
1821. Mar. 8.		Brandreth, Thomas Shaw, Esq. *University-club.*
1841. Jan. 21.		† Brandreth, Henry Rowland, Major R.E. *Board of Trade.*
1834. June 5.		† Breadalbane, John, Marquis of, K.T. 21 *Park-lane; and Taymouth-castle, Aberfeldie.*

Date of Election.			
1815. May 4.	C. Rm. R.P.		Brewster, Sir David, K.H. LL.D. F.R.S.E. Hon. M.R.I.A. F.G.S. F.R.A.S. Instit. Reg. Sc. Paris. Corresp.—Soc. Reg. Sc. Gotting. Socius. Principal of St. Leonard's College. *St. Andrew's.*
1838. Nov. 22.		†	Briggs, Major-General John, E.I.C.S. M.R.A.S. F.G.S. 3 *Charles-street, St. James's.*
1821. Mar. 8.			Bright, Richard, M.D. Coll. Reg. Med. Socius, F.G.S. Soc. Reg. Med. Hafn. Socius.—Acad. Sc. Sien., Socc. Erud. Hung., et Medico-Chir. Berolin. Corresp. 11 *Saville-row.*
1810. May 10.			Brisbane, Lieut.-General Sir Thomas Macdougall, Bart. K.C.B. G.C.H. D.C.L. President of the Royal Society of Edinburgh, Hon. M.R.I.A. F.R.A.S. F.L.S. Instit. Reg. Sc. Paris. Corresp. *Makerstown, Kelso.*
1805. May 23.			Bristol, Frederick William, Marquis of. 6 *St. James's-square; and Ickworth-park, Bury St. Edmunds.*
1834. Dec. 18.		†	Brockedon, William, Esq. 29 *Devonshire-street, Queen-square.*
1828. Feb. 14.			Broderip, William John, Esq., B.A. F.L.S. F.G.S. 2 *Raymond-buildings, Gray's-inn.*
1810. Feb. 15.	C.P.	*	Brodie, Sir Benjamin Collins, Bart. Serjeant Surgeon to the Queen. Inst. Reg. Paris. Corresp. 14 *Saville-row.*
1817. Mar. 13.			Bromhead, Sir Edward Ffrench, Bart. M.A. F.R.S.E. F.R.A.S. *Thurlby, Lincolnshire.*
1823. May 29.			Brooke, Sir Arthur Brooke de Capell, Bart. M.A. F.L.S. F.G.S. *Okeley, Northamptonshire.*
1847. Mar. 4.	P.	†	Brooke, Charles, Esq., B.A. 29 *Keppel-street, Russell-square.*
1819. Apr. 22.			Brooke, Henry James, Esq., F.L.S. F.G.S. *Clapham-rise.*
1803. Mar. 3.	P.		Brougham and Vaux, Henry, Lord, M.A. Instit. Reg. Sc. Paris. Socius. 4 *Grafton-street; and Brougham-hall, Penrith.*
1842. Feb. 17.		†	Broughton, Robert Edwards, Esq. 1 *Melcombe-place.*
1811. Dec. 12.	C.		Brown, Robert, Esq., D.C.L. Hon. Mem. R.S.Ed., R.I.Acad., Med.-Chirurg. S., and C.P.S. V.P.L.S. Instit. Reg. (Acad. Scient.) Paris. Socius.—Acadd. Reg. Scient. Berol., et Taurin., Imp. Sc. Petrop., Reg. Sc. Holm., Monach., Neapol., Bruxell. et Bonon., Instit. Reg. Sc. Amstelod., Socc. Reg. Sc. Hafn., et Upsal., Acadd. Cæs. Nat. Cur., et Imp. Geor. Florent., Socc. Sc. Harlem., Trajectin., Phys. et Hist. Nat. Genev., Imp. Hist. Nat. Mosc., Socc. Nat. Scrutat. Berolin., Wetter., Phil. Nov.-Ebor., Med. et Phys. Bengal., Med. Holm. et Geogr. Berolin. Socius. 17 *Dean-street, Soho.*
1838. May 8.			Brownlow, John, Earl, D.C.L. F.S.A. F.L.S. F.G.S. M.R.A.S. 12 *Belgrave-square; and Belton-house, Grantham.*
1829. Mar. 18.			Bruce, Right Hon. Sir James Lewis Knight, Knt. F.S.A. Vice-Chancellor. *Roehampton Priory.*
1830. June 10.			Brunel, Isambard Kingdom, Esq. 18 *Duke-street, Westminster.*
1814. Mar. 24.			Brunel, Sir Mark Isambard, Knt., Instit. Reg. Sc. Paris., et Acad. Reg. Sc. Monach., Corresp.
1833. June 20.			Buccleuch, Walter Francis, Duke of, K.G. D.C.L. F.L.S. *Whitehall-gardens; and Dalkeith-house, Edinburgh.*
1818. Feb. 26,	C.P.		Buckland, Very Rev. William, D.D., Dean of Westminster, F.L.S. V.P.G.S. Trust. Brit. Mus., Instit. Reg. Sc. Paris. Corresp., Acad. Sc. Bonon. Socc. Min. Imp. Petrop. et Cæs. Nat. Cur. Mosc., Socius. *Deanery, Westminster.*

Date of Election.		
1836. Jan. 21.		† Budd, George, M.D. Coll. Reg. Med. Socius. 20 *Dover-street, Piccadilly; and Caius-college, Cambridge.*
1846. Jan. 29.		† Buist, George, Esq., D.C.L. *Bombay.*
1829. Dec. 10.		Burlington, William, Earl of, M.A. Chancellor of the University of London.—F.G.S. 10 *Belgrave-square; and Hardwick-hall, Derbyshire.*
1835. April 2.		Burnes, James, K.H. D.C.L. *India.*
1837. Mar. 16.		† Burnet, John, Esq. 12 *Sloane-street.*
1838. May 3.		† Burnet, Rev. Thomas, D.D., Rector of St. James, Garlickhythe. 13 *Finsbury-sq.*
1833. Apr. 18.	P.	† Burnett, Sir William, K.C.H. M.D. Coll. Reg. Med. Socius.—Acad. Med. et Chir. Petrop. Socius Honor. 5 *Somerset-place.*
1814. Dec. 22.		Burney, Rev. Charles Parr, D.D. F.S.A. F.L.S. F.G.S. F.R.A.S. M.R.A.S. M.R.S.L. *Rectory-house, Sible Hedingham, near Halsted, Essex.*
1829. April 1.		Burns, John, M.D. *Glasgow.*
1818. Feb. 26.		Burrow, Rev. Edward John, D.D. F.G.S. *Gibraltar.*
1847. Apr. 22.		† Burrows, George, M.D. Coll. Reg. Med. Socius. 45 *Queen Anne-street, Cavendish-square.*
1836. Mar. 17.		Burt, Major T. Seymour, M.R.A.S. *India.*
1832. Dec. 6.		Burton, Decimus, Esq., F.S.A. 6 *Spring-gardens; and St. Leonard's, Hastings.*
1836. May 5.		† Burton, Edward, Esq., F.L.S. *Brooklyn, near Maidstone.*
1844. Feb. 1.		† Bury, Edward, Esq. *Hanslope-park, Newport Pagnell.*
1818. Jan. 8.		Bute, John, Marquis of, K.T. D.C.L. F.S.A. F.R.A.S. F.G.S. *Mountstuart, Bute; Dumfries House, Ayrshire; and Cardiff-castle, Glamorganshire.*
1819. May 20.		Butler, The Very Rev. George, D.D. Dean of Peterborough, F.S.A. F.R.A.S.
1822. Mar. 21.		Butter, John, M.D. F.L.S. *Windsor-villas, Plymouth; and Corringdon-hall, South-Brent, Devonshire.*
1837. Jan. 19.		Cabbell, Benjamin Bond, Esq., F.S.A. 1 *Brick-court, Temple; and Portland-place.*
1810. June 28.		Cadell, William Archibald, Esq., F.R.S.E. F.G.S. *Edinburgh.*
1831. Mar. 10.	P.	Caldcleugh, Alexander, Esq., F.L.S. F.G.S. *Chili.*
1840. Feb. 20.		Caldecott, John, Esq., F.R.A.S. *Observatory, Travancore, India.*
1796. Nov. 17.		Canterbury, Right Hon. William Howley, D.D., Lord Archbishop of, Trust. Brit. Mus. F.S.A. M.R.S.L. *Lambeth-palace.*
1839. Feb. 14.		† Carington, Robert John, Lord. *Whitehall-yard; and Wycombe-abbey and Gayhurst, Bucks.*
1826. Feb. 9.		Carleton, Hon. and Rev. Richard, M.A. *Greywell-hill, Odiham, Hampshire.*
1818. May 28.	P.	Carne, Joseph, Esq., M.R.I.A. F.G.S. *Penzance.*
1844. Feb. 1.		† Carpenter, William Benjamin, M.D. 6 *Regent's-park-terrace.*
1800. Dec. 18.		Carrington, Sir Codrington Edmund, Knt. D.C.L. F.S.A. M.R.A.S.
1841. Feb. 11.		Cartwright, Samuel, Esq., F.L.S. 32 *Old Burlington-street.*
1846. Apr. 2.		† Cautley, Proby T., Major, F.G.S. *India.*
1812. June 11.		Cawdor, John Frederick, Earl, Trust. Brit. Mus. F.G.S. 74 *South Audley-street; and Cawdor-castle, Nairn.*
1828. Mar. 13.		Chambers, William Frederick, M.D. K.C.H. Physician to the Queen. Coll. Reg. Med. Socius. 46 *Brook-street.*
1833. Feb. 7.		† Chandler, Very Rev. George, Dean of Chichester, D.C.L. M.R.S.L. R.G.S. 36 *Mortimer-street.*

Date of Election.		
1816. Nov. 21.		Chapman, Major-Gen. Sir Stephen Remnant, C.B. K.C.H. R.E. *Tainfield-house, Taunton, Somerset.*
1836. Apr. 28.	†	Chapman, John James, Esq., Capt. R.A. *Athenæum Club.*
1842. May 26.		Chapman, Thomas, Esq., F.S.A. *Whitby, Yorkshire.*
1834. Feb. 6.		Chesney, Lieut.-Colonel Francis Rawdon, R.A. 11 *Wilton-terrace, Grosvenor-place.*
1807. Mar. 12.	P.	Children, John George, Esq., F.R.S.E. F.S.A. F.L.S. 48 *Torrington-square.*
1847. Mar. 18.	P.	Christie, James Robert, Esq. *Woolwich.*
1826. Jan. 12.	P.	Christie, Samuel Hunter, Esq., M.A.—SECRETARY.—V.P.R.A.S. F.C.P.S., Professor of Mathematics, Royal Military Academy. Acad. Sc. et Lit. Panorm., et Soc. Philom. Paris. Corresp. *Royal Military Academy, Woolwich.*
1842. Apr. 14.	†	Christmas, Rev. Henry, M.A. F.S.A. *Sion College, London Wall.*
1833. Apr. 18.		Christopher, Robert Adam Dundas, Esq. 97 *Eaton-square.*
1818. Dec. 10.		Churchill, Francis Almaric, Lord. *Cornbury-park, near Witney, Oxfordshire.*
1832. June 7.		Clark, Sir James, Bart. M.D. Physician to the Queen. 22 *B, Brook-street.*
1836. Jan. 28.	†	Clark, William, M.D. *Cambridge.*
1837. May 11.	†	Clark, William Tierney, Esq. *Hammersmith.*
1825. June 9.		Clarke, Sir Charles Mansfield, Bart. M.D., LL.D. Coll. Reg. Med. Socius. *Wigginton-lodge, Tamworth.*
1820. May 18.		Clarke, Loftus Longueville, Esq., M.A. *India.*
1841. Feb. 18.	†	Clendinning, John, M.D. Coll. Reg. Med. Socius. 16 *Wimpole-street.*
1819. May 27.		Clerk, Right Hon. Sir George, Bart. D.C.L. M.P. F.R.S.E. F.G.S. 8 *Park-street, Westminster.*
1833. Apr. 18.	†	Clerke, Major Thomas Henry Shadwell, K.H. R.E. F.R.A.S. 4 *Brompton-grove.*
1823. May 8.	P.	Clift, William, Esq., F.G.S. *Stanhope-cottage, Mornington-road, Regent's-park.*
1820. Dec. 21.		Cockburn, Vice-Admiral Right Hon. Sir George, G.C.B. G.C.H. F.R.A.S.
1822. Nov. 21.		Codrington, Vice-Admiral Sir Edward, G.C.B. *Admiralty-house, Portsmouth; and Hampton-lodge, Brighton.*
1820. Apr. 13.		Colby, Major-General Thomas, R.E. LL.D. F.R.S.E. Hon. M.R.I.A. F.G.S. F.R.A.S. M.R.A.S. *Ordnance Map Office, Southampton.*
1830. Feb. 18.		Collier, Charles, M.D. F.G.S. 20 *Fitzroy-square.*
1830. Jan. 14.	†	Colquhoun, Lieut.-Colonel James Nisbet, R.A. *Athenæum Club.*
1819. Dec. 9.		Conybeare, Very Rev. William Daniel, Dean of Llandaff, M.A. F.G.S. Instit. Reg. Sc. Paris. Corresp. *Deanery, Llandaff.*
1840. June 4.	†	Cook, Thomas, Esq., Lieut. R.N., Professor of Fortification, E.I.C. Military Academy. *Addiscombe.*
1829. June 18.	P.	Cooper, Bransby Blake, Esq. 2 *New-street, Spring-gardens.*
1832. Dec. 6.		Cooper, Charles Purton, Esq., LL.D. Hon. M.R.I.A. 7 *New Boswell-court, Lincoln's-inn.*
1846. Feb. 5.	†	Cooper, Samuel, Esq. 7 *Woburn-place.*
1834. Feb. 6.		Copeland, Thomas, Esq. 17 *Cavendish-square.*
1833. Dec. 5.	†	Copland, James, M.D. Coll. Reg. Med. Socius, Soc. Amer. Philad. Socius. 5 *Old Burlington-street.*
1821. May 24.		Cotton, William, Esq., F.S.A. 3 *Crosby-square, Bishopsgate-street; and Walwood-house, Leytonstone.*
1836. May 5.	†	Cox, William Sands, Esq. *Birmingham.*

Date of Election.		
1812. Apr. 16.		Crampton, Sir Philip Cecil, Bart. D.C.L. *Dublin.*
1818. May 7.		Crawford, John, Esq., F.L.S. F.G.S. M.R.A.S.
1842. Dec. 22.		Creuze, Augustin F. B., Esq. 14 *Grosvenor-place, New-road, Kennington.*
1800. May 8.	*	Crichton, Sir Alexander, Knt. M.D. Grand Cross of St. Ann and St. Vladimir, F.L.S. F.G.S. Acad. Imp. Sc. Petrop., et Soc. Imp. Hist. Nat. Mosc., Socius.—Soc. Reg. Sc. Gotting. Corresp. *Seal Chart, near Sevenoaks, Kent.*
1818. Mar. 5.		Croft, Sir John, Bart. K.T.S. D.C.L. Acad. Reg. Olyssip. Socius. *Milgate, near Maidstone.*
1810. July 5.		Croker, Right. Hon. John Wilson, LL.D.
1836. Feb. 18.	†	Crosse, John Green, M.D. Acad. Reg. Med. Paris., Soc. Reg. Med. Hafn. Med. Chir. Berolin., Soc. Amer. Philad. Socius. *Norwich.*
1843. Dec. 7.	P. †	Crozier, Francis Rawdon Moira, Esq., Capt. R.N.
1844. Feb. 29.		Crum, Walter, Esq. *Thornlie Bank, near Glasgow.*
1830. Apr. 1.		Cubitt, William, Esq., M.R.I.A. F.R.A.S. 6 *Great George-street, Westminster.*
1807. Jan. 22.		Cuming, Lieut.-General Hon. John Leslie.
1816. Jan. 11.		Cumming, Rev. James, M.A., Professor of Chemistry, Cambridge, F.G. *Cambridge.*
1838. Jan. 25.	†	Cureton, Rev. William, M.A. 37 *Queen Anne-street; and British Museum.*
1841. May 27.		Cursetjee, Ardaseer, Esq. *Bombay.*
1834. Feb. 6.	†	Cust, Hon. Sir Edward, K.C.H. 30 *Hill-street.*
1828. June 5.	†	Daniell, Edmund Robert, Esq. *Birmingham.*
1822. Nov. 7.		Dartmouth, William, Earl of, D.C.L. F.S.A. 23 *St. James's-square; and Sandwell-park, Birmingham.*
1834. Jan. 29.	P.	Darwin, Charles, Esq., M.A. Sec. G.S. *Down, near Bromley, Kent.*
1788. Feb. 21.	P.	Darwin, Robert Waring, M.D. *Shrewsbury.*
1822. Dec. 19.	P.	Daubeny, Charles Giles Bridle, M.D., Aldrich's Professor of Chemistry, and Regius Professor of Botany, Oxford. Hon. M.R.I.A. F.L.S. F.G.S. Coll. Reg. Med. Socius. *Oxford.*
1839. May 30.	†	Davenport, Edward Davies, Esq. 28 *Lower Brook-street; and Capesthorne, Cheshire.*
1831. June 16.		Davies, Griffith, Esq. 25 *Duncan-terrace, City-road.*
1833. Apr. 18.	P.	Davies, Thomas Stephens, Esq., F.R.S.E. F.S.A. *Royal Military Academy, Woolwich.*
1841. May 20.	†	Davis, Hart, Esq. 17 *Oxford-square, Hyde-park.*
1822. Mar. 28.		Davis, Sir John Francis, Bart. *Portland-place; and Hollywood, near Compton, Bristol.*
1826. Jan. 19.	P.	Davy, Edmund, Esq., Prof. of Chemistry to the Royal Dublin Society, M.R.I.A. *Dublin.*
1814. Feb. 17.	P.	Davy, John, M.D. F.R.S.E. Inspector-General of Army Hospitals. *Barbados; and Ambleside, Westmoreland.*
1815. Mar. 9.		Dawkins, James Colyer, Esq., F.S.A. *Ham-common, Richmond.*
1805. Feb. 21.		De Blaquiere, Lord. *Holly House, New Kent-road.*
1819. Dec. 23.		De la Beche, Sir Henry Thomas, Knt.—VICE-PRESIDENT.—F.L.S. F.G.S., Director-General of the Geological Survey of the United Kingdom. *Museum of Economic Geology, 6 Craig's-court, Charing-cross.*

Date of Election.		
1839. Feb. 28.	†	Denham, Henry Mangles, Esq., Captain R.N. 89 *Pall Mall; and Athenæum.*
1841. May 20.	†	Denham, Rev. Joshua Frederick, M.A. 1 *New Inn.*
1838. Feb. 22.		Denison, Sir William Thomas, Capt. R.E. F.R.A.S. F.R.G.S. Lieut. Governor, Van Diemen's-Land.
1833. June 20.	†	Denman, Thomas, Lord. 38 *Portland-place; and Stoney-Middleton, Derbyshire.*
1829. Feb. 19.		D'Eyncourt, Right Hon. Charles Tennyson, F.S.A. 35 *Pall Mall.*
1845. Mar. 6.	†	Dickenson, John, Esq., F.G.S. F.R.G.S. F.A.S. *Abbott's-hill, Hemel Hempstead.*
1804. Feb. 2.	P.	Dillwyn, Lewis Weston, Esq., F.L.S. F.G.S. *Sketty-hall, near Swansea.*
1832. June 7.	†	Disney, John, Esq., F.S.A. *The Hyde, near Ingatestone, Essex.*
1811. Mar. 21.		Dixon, Rev. Richard, M.A. *Niton, Isle of Wight.*
1819. Dec. 23.	P.	Dollond, George, Esq., F.R.A.S. 59 *St. Paul's Churchyard; and North-terrace, Camberwell.*
1838. Jan. 18.	†	Donkin, Bryan, Esq., F.R.A.S. 6 *Paragon, Kent-road.*
1842. Jan. 13.	†	Donkin, William Fishburn, Esq., M.A., Savilian Professor of Astronomy in the University of Oxford. *Oxford.*
1830. Jan. 28.		Douglas, George, Esq. *Chilston, Kent.*
1816. Jan. 25.	*	Douglas, Major-General Sir Howard, Bart. C.B. K.S.C. D.C.L. F.S.A. 15 *Green-street, Grosvenor-square.*
1826. Mar. 9.		Douglas, Lord William Robert Keith.
1836. Feb. 4.	†	Drory, George William, Esq. 38 *Westbourne-terrace, Hyde-park.*
1839. Dec. 19.	†	Drummond, Henry, Esq. *Albury-park, Guildford, Surrey.*
1808. Dec. 8.		Duckett, Sir George, Bart. M.A. F.S.A. F.G.S. Hon. M.R.I.S.
1825. Mar. 10.		D'Urban, Major-General Sir Benjamin, K.C.B. K.C.H. K.T.S.
1824. Feb. 19.		Durham, Edward Maltby, D.D. Lord Bishop of, F.S.A. 4 *Upper Portland-place; and Auckland-castle, Durham.*
1847. Apr. 22.	†	Dwarris, Sir Fortunatus, Knt. B.A. F.S.A. 5 *James-street, St. James's-park.*
1838. Jan. 25.	†	Eastlake, Charles Locke, Esq., R.A. 13 *Upper Fitzroy-street.*
1835. Feb. 5.	†	Edye, John, Esq. 9 *Mecklenburgh-square.*
1841. Jan. 21.	†	Edye, Joseph, Esq.
1831. Feb. 10.		Egerton, Sir Philip de Malpas Grey, Bart. F.G.S. 30 *Eaton-place*; *and Oulton-park, Cheshire.*
1815. Mar. 2.		Elliot, Sir William Francis, Bart. *Stobb's-castle; and Wells, N.B.*
1834. June 5.		Elliot, Hon. George, Rear-Admiral. 88 *Eaton-place.*
1829. Mar. 19.		Elliotson, John, M.D. Coll. Reg. Med. Socius. 37 *Conduit-street.*
1835. Nov. 26.	†	Elliott, Charles, Esq. 47 *Portland-place.*
1832. Apr. 5.		Elliott, Rev. Charles Boileau, M.A. 47 *Portland-place; and Tattingstone, Suffolk.*
1811. May 30.	*	Ellis, Sir Henry, K.H. B.C.L. Sec.S.A. Hon. M.R.I.A. Hist. Scand. Holm. et Soc. Reg. Antiq. Hafn. Socius.—Soc. Reg. Antiq. Franc. Corresp. Principal Librarian of the British Museum. *British Museum.*
1819. Feb. 11.		Ellis, Right Hon. Henry, F.G.S.
1847. Apr. 15.	†	Ellis, Thomas Flower, Esq., M.A. F.R.A.S. F.C.P.S., Attorney-General of the Duchy of Lancaster. 15 *Bedford-place.*
1832. June 7.	†	Elphinstone, Sir Howard, Bart. M.A. F.G.S.
1841. Jan. 14.		Enderby, Charles, Esq., F.L.S. *Greenwich.*
1841. May 6.	†	Enfield, Viscount. 77 *Eaton-square.*

Date of Election.		
1829. Jan. 15.		Enniskillen, William Willoughby, Earl of, D.C.L. F.G.S. *Athenæum Club; and Florence-court, Fermanagh, Ireland.*
1827. Mar. 8.		Everest, Lieut.-Colonel George, Bengal Artillery, F.G.S. F.R.A.S. M.R.A.S. 37 *Connaught-square, Hyde-park.*
1840. May 21.		† Ewer, Walter, Esq. 23 *Hanover-square.*
1845. Feb. 13.		† Falconer, Hugh, M.D. F.L.S. F.G.S. Superintendent of the E.I.C. Botanic Garden, Calcutta.
1824. Jan. 8.	C. Rm. R.P.	Faraday, Michael, Esq., D.C.L., Fullerian Professor of Chemistry in the Royal Institution of Great Britain. Hon. Mem. R.S.E., and C.P.S. F.G.S. Instit. Reg. (Acad. Sc.) Paris. Socius, Acad. Imp. Sc. Petrop. Socius Honor.—Acad. Reg. Sc. Holm., Soc. Reg. Sc. Hafn., Acad. Reg. Sc. Mut., Acad. Amer. Art. et Sc. Bost. Socius, Acad. Reg. Sc. Berol., Soc. Georg. Florent., Soc. Philom. Paris., et Acad. Reg. Med. Paris. Corresp. 21 *Albemarle-street.*
1839. May 2.	P.	† Farre, Arthur, M.D. Coll. Reg. Med. Socius. 22 *Curzon-street, May-fair.*
1835. April 2.		† Featherstonhaugh, G. W., Esq. *Havre.*
1816. Feb. 29.		Fellowes, Sir James, Knt. M.D. Coll. Reg. Med. Socius. *Pangbourne-lodge, near Reading.*
1836. Mar. 3.		Field, Joshua, Esq. *Cheltenham-place, Lambeth.*
1842. May 5.		† Fielding, George Hunsley, Esq. *The Bower, Maidstone.*
1825. Jan. 27.	P.	Fisher, Rev. George, M.A. F.R.A.S. *Royal Hospital, Greenwich.*
1815. Nov. 9.		Fitton, William Henry, M.D. F.L.S. F.G.S. F.R.A.S. Coll. Reg. Med. Socius. 53 *Upper Harley-street.*
1811. Jan. 17.		Fitzwilliam, Charles William, Earl, F.S.A. F.G.S. *Mortimer-house, Grosvenor-place; and Wentworth-house, near Rotherham, Yorkshire.*
1839. Mar. 21.		Fletcher, Thomas William, Esq., F.S.A. *Dudley, Worcestershire.*
1834. Apr. 10.		† Ffolkes, Sir William Browne, Bart. *Hillington-hall, Lynn.*
1845. Feb. 13.		† Forbes, Edward, Esq., F.L.S. F.G.S. Professor of Botany at King's College. Palæontologist to the Geological Survey of Great Britain. *King's College.*
1832. June 7.	Rm. R.P.	Forbes, James David, Esq., Professor of Natural Philosophy in the University of Edinburgh. Sec. R.S.E. F.G.S. Instit. Reg. Sc. Paris. Corresp. *Edinburgh.*
1829. Feb. 5.		Forbes, John, M.D. Coll. Reg. Med. Socius. 12 *Old Burlington-street.*
1822. Feb. 21.		Forbes, William Nairn, Esq., F.G.S.
1828. June 12.		† Forshall, Rev. Josiah, M.A. F.S.A. Hon. M.R.I.A. M.R.S.L. *British Museum.*
1821. Feb. 22.		Forster, Edward, Esq., V.P.L.S. 11 *Mansion-house-street; and Woodford, Essex.*
1817. June 5.		Fortescue, Hugh, Earl, K.P. 17 *Grosvenor-square; and Castle-hill, Southmolton.*
1802. April 1.		Fowler, Richard, M.D. F.S.A. *Salisbury.*
1845. Feb. 13.	R.P.	Fownes, George, Esq., Professor of Practical Chemistry, University College, London.
1823. Feb. 20.		Franklin, Sir John, Knt. Capt. R.N. D.C.L. F.L.S. F.R.G.S. F.G.S. F.R.A.S. Acad. Scient. Paris. et Soc. Geogr. Paris. Corresp.
1821. Dec. 12.		Franks, William, Esq., M.A. *Wood-hill, Hatfield, Hertfordshire.*
1837. June 8.		Frere, George Edward, Esq. *Roydon-hall, Diss, Norfolk.*
1834. Apr. 10.		† Freshfield, James William, Esq., F.G.S. 15 *Regent-street; and Leatherhead, Surrey.*
1820. Mar. 16.		Friend, Matthew Curling, Esq., Lieut. R.N. *George Town, Van Diemen's Land.*
1839. Jan. 10.		† Frodsham, William James, Esq. *Change-alley, Cornhill.*
1834. Dec. 18.		† Galloway, Thomas, Esq., M.A. F.R.A.S. 45 *Torrington-square.*

Date of Election.			
1816. April 4.			Gardiner, Rev. Samuel John, M.A.
1839. Mar. 21.			Gaskin, Rev. Thomas, M.A. F.R.A.S. *Jesus-College, Cambridge.*
1840. April 9.	P.	†	Gassiot, John P., Esq. *Clapham-common.*
1796. Feb. 18.			Gibbes, Sir George Smith, Knt. M.D. F.L.S. Coll. Reg. Med. Socius. 2 *Oriel-place, Cheltenham.*
1846. June 18.			Gilbart, James William, Esq. *London and Westminster Bank, Lothbury.*
1834. Apr. 10.			Gilbert, John Davies, Esq., M.A. *Eastbourne, Sussex; and Trelissick, Truro.*
1828. Mar. 27.			Glenelg, Charles, Lord, D.C.L. M.R.S.L. *The Albany, Piccadilly; and Glenelg, Inverness.*
1838. Feb. 8.			Glynn, Joseph, Esq. *Butterley, Derbyshire.*
1839. Mar. 7.		†	Godwin, George, jun., Esq., F.S.A. 11 *Pelham-crescent, Brompton.*
1808. May 26.	P.		Goldingham, John, Esq., F.R.A.S. M.R.A.S. *Worcester.*
1828. Mar. 13.			Goldsmid, Baron De, and De Palmeira, F.S.A. F.L.S. F.G.S. F.R.A.S. M.R.S.L. *Park-lodge, Regent's-park.*
1819. Jan. 29.	P.		Gompertz, Benjamin, Esq., F.R.A.S. *Kennington-terrace, Vauxhall.*
1846. June 11.		†	Goodsir, John, Esq., Professor of Anatomy, University of Edinburgh. 21 *Lothian-street, Edinburgh.*
1835. April 2.		†	Gordon, James Alexander, M.D. Coll. Reg. Med. Socius. *Pelican Life Assurance Office, Lombard-street.*
1801. June 11.			Gordon, Lieut.-General Sir James Willoughby, Bart. K.C.B. G.C.H. *Chelsea.*
1830. Dec. 9.			Gordon, Henry Percy, Esq., M.A. *Chelsea.*
1821. Feb. 8.			Gordon, Thomas, Esq. *Zante, Ionian Islands.*
1820. Apr. 27.			Goulburn, Right Hon. Henry, D.C.L. *Montagu-place, Portman-square.*
1843. Jan. 19.			Gould, John, Esq., F.L.S. 20 *Broad-street, Golden-square.*
1831. Dec. 22.			Graham, Right Hon. Sir James R. G., Bart. 46 *Grosvenor-place; and Netherby, Cumberland.*
1836. Dec. 25.	R.P.		Graham, Thomas, Esq., M.A.—Vice-President.—Professor of Chemistry, University College, London, F.G.S. Hon. Memb. R.S.Ed. National Inst. Washington, U.S. Inst. Reg. Sc. Paris. et Acad. Reg. Sc. Berolin. et Monach. Corresp. 9 *Torrington-square.*
1846. Jan. 22.		†	Grainger, Richard Dugard, Esq., F.R.C.S. F.M.C.S. *Highgate.*
1840. May 21.		†	Grant, Thomas Tassel, Esq. *Royal Clarence Victualling-yard, Portsmouth.*
1836. Feb. 4.			Grant, Robert Edmond, M.D. F.R.S.E. F.L.S. Professor of Comparative Anatomy and Zoology in University College. 10 *Grafton-place, Euston-square.*
1817. Nov. 20.	P.		Granville, Augustus Bozzi, M.D. F.G.S. M.R.A.S. Acadd. Reg. Sc. Brux., Acadd. Luc. et Pat.: Socc. Geogr. Flor., Ital., Vienn., Sc. Nat. Neap., Athen. Ven., Philom. Paris., Socius.—Acad. Imp. Sc. Petrop. et Reg. Taurin. Corresp. 109 *Piccadilly.*
1832. Feb. 2.			Gravatt, William, Esq. 34 *Parliament-street.*
1839. Apr. 18.	P.		Graves, John Thomas, Esq., M.A. M.R.S.L. *Poor-Law Commission Office, Somerset-house.*
1832. Feb. 2.	P.		Gray, John Edward, Esq., F.G.S. F.R.G.S. Soc. Imp. Hist. Nat. Mosc. Acadd. Lync. Romæ, Sc. Nat. Philad. et Hist. Nat. Boston., Socius. *British Museum.*
1825. Feb. 24.			Green, Joseph Henry, Esq., Professor of Anatomy to the Royal Academy, F.G.S. *Barnet.*
1807. Mar. 5.			Greenough, George Bellas, Esq., F.L.S. F.G.S. M.R.A.S. *Grove-house, Regent's-park.*

Date of Election.			
1833. Feb. 7.			Greig, Woronzow, Esq., M.A. 14 *Lower Belgrave-street, Eaton-square.*
1830. June 10.			Gresswell, Rev. Richard, M.A. *Worcester College, Oxford.*
1841. Apr. 29.		†	Grey, Thomas Philip, Earl de, K.G. K.P. 4 *St. James's-square; and West-park, Silsoe, Bedfordshire.*
1834. Apr. 10.		†	Griffith, Edward, Esq. 6 *Nottingham-terrace, Marylebone.*
1806. May 1.	P.		Griffiths, John, Esq.
1840. Nov. 26.	R.P.		Grove, William Robert, Esq., M.A. Ph. D. V.P.R.I. Acad. Reg. Taurin. Corresp., et Soc. Phil. Basil. 27 *Upper Gloucester-place, Dorset-square; and* 4 *Hare-court, Temple.*
1839. June 20.			Guest, Edwin, Esq. 4 *King's-bench-walk, Temple.*
1830. June 10.			Guest, Sir Josiah John, Bart. F.G.S. 8 *Spring-gardens; and Dowlais Iron-works, Glamorganshire.*
1839. Mar. 7.			Gulliver, George, Esq. *Royal Regiment of Horse Guards.*
1818. Jan. 15.			Gurney, Hudson, Esq., F.S.A. M.R.S.L. 9 *St. James's-square; and Keswick-hall, near Norwich.*
1827. May 24.			Guthrie, George James, Esq. 4 *Berkeley-street, Piccadilly.*
1844. Apr. 18.		†	Haddington, Right Hon. Thomas, Earl of, K.P. *Tyningham-castle, Dunbar.*
1820. Apr. 27.		*	Hall, Sir John, Bart. F.R.S.E. F.G.S. 63 *Lowndes-square; and Dunglass, Dunbar, Haddingtonshire.*
1832. April 5.	P.		Hall, Marshall, M.D. F.R.S.E. Coll. Reg. Med. Socius. 14 *Manchester-square.*
1827. Nov. 22.			Hall, Thomas Henry, Esq., M.A. 49 *Tavistock-square.*
1847. Apr. 22.		†	Hall, William Hutcheson, Esq., Capt. R. N. *Shipbourne-lodge, Tunbridge.*
1821. Mar. 8.			Hallam, Henry, Esq., M.A. Trust. Brit. Mus. V.P.S.A. F.G.S. F.R.A.S. M.R.S.L. Instit. Reg. Sc. Paris. Socius. 24 *Wilton-crescent, Knightsbridge.*
1839. May 30.		†	Halliwell, James Orchard, Esq., Hon. M.R.I.A. F.S.A.L. & E. F.R.A.S. Hon. M.R.S.L. Socc. Reg. Antiq. Franc., Reg. Antiq. Septen. Hafn., Ethnol. Paris., Reg. Geogr. Paris., Asiatic. Paris., Corresp. *Avenue-lodge, Brixton-hill.*
1808. Jan. 14.			Hamilton and Brandon, Alexander, Duke of, K.G. F.S.A. 12 *Portman-square; and Hamilton-palace, Lanarkshire.*
1828. Jan. 17.			Hamilton, Rev. H. Parr, M.A. F.G.S. F.R.A.S. *Wath Rectory, near Ripon.*
1813. April 8.			Hamilton, William Richard, Esq., V.P.S.A. V.P. R.S.L. Trust. Brit. Mus., Acad. Reg. Sc. Berolin. Socius Honor. 12 *Bolton-row, May-fair.*
1838. Jan. 18.		†	Hansler, Sir John Jacob, Knt. F.S.A. 8 *Westbourne-street, Hyde-park-gardens.*
1824. Apr. 29.			Harcourt, Rev. W. Venables Vernon, M.A. Hon. M.R.I.A. F.G.S. *Weldrake, near York.*
1838. April 5.		†	Hardwick, John, Esq., D.C.L. 5 *K, Albany, Piccadilly.*
1831. Dec. 8.			Hardwick, Philip, Esq., R.A. F.S.A. 60 *Russell-square.*
1847. Feb. 25.			Hardwicke, Earl of. *Wimpole-hall, Arrington, Cambridge.*
1839. Jan. 17.		†	Hardy, Peter, Esq. 37 *Old Jewry; and* 10 *Victoria-square, Pimlico.*
1823. May 29.			Harford, John Scandret, Esq., D.C.L.
1844. Apr. 18.	P.	†	Hargreave, Charles James, Esq., B.L. Professor of Jurisprudence, University College, London. 69 *Chancery-lane.*
1835. Feb. 5.		†	Harris, John Greathed, Esq., M.A. 25 *Chester-street.*
1831. June 2.	C.P.		Harris, Sir William Snow, Knt. *Windsor Villas, Plymouth.*
1845. May 8.		†	Harrison, Thomas Charles, Esq. 31 *York-terrace, Regent's-park.*
1825. Feb. 17.			Harvey, Henry, Esq., F.R.A.S. 59 *Regency-square, Brighton.*

Date of Election.			
1835. April 2.		†	Harvey, Major-General Sir Robert John, C.B. K.T.S. K.S.B. F.S.A. *United Service Club; and Mousehold-house, near Norwich.*
1827. May 24.	P.	†	Harwood, John, M.D. F.L.S. *St. Leonard's, Hastings.*
1812. Jan. 9.			Hasted, Rev. Henry, M.A. F.L.S. *Bury, Suffolk.*
1821. Nov. 15.			Haughton, Sir Graves Chamney, K.H. M.A. Hon. M.R.I.A. M.R.A.S., Instit. Reg. Sc. Paris. Socius, Acad. Reg. Berolin. Corresp. 14 *Grafton-street, Bond-street.*
1834. Dec. 18.			Hawkins, Bissett, M.D. Coll. Reg. Med. Socius. 30 *Golden-square.*
1821. May 24.		*	Hawkins, Edward, Esq., F.S.A. F.L.S. *British Museum.*
1791. May 5.			Hawkins, John, Esq.
1830. June 10.			Hawkins, John Heywood, Esq., M.A. F.G.S. *Reform Club; and Bignor-park, Petworth, Sussex.*
1835. Nov. 19.		†	Hawkins, Rev. William B. L., M.A. 23 *Great Marlborough-street.*
1814. Mar. 3.			Hay, Robert William, Esq., F.S.A.
1818. May 28.		*	Heath, George Crauford, Esq. *Cambridge.*
1843. Feb. 2.		†	Heath, John Benjamin, Esq., F.S.A. 66 *Russell-square.*
1846. April 23.			Henry, Thomas Hetherington, Esq. *Brick-lane, Spitalfields.*
1834. Apr. 10.			Henry, William Charles, M.D. *Haffield, near Ledbury, Herefordshire.*
1840. Feb. 27.		†	Henwood, William Jory, Esq. 4 *Clarence-street, Penzance.*
1813. May 27.	C.R. P.		Herschel, Sir John Frederick William, Bart.—Vice-President.—D.C.L. M.A. Trust. Brit. Mus. F.R.S.E. Hon. M.R.I.A. F.G.S. M.C.P.S. Instit. Reg. Sc. Paris. Corresp.—Acadd. Imp. Sc. Petrop., Reg. Berol., Taurin. Neap. et Brux.: Socc. Reg. Gotting., Hafn. et Harl.: Acadd. Lync. Romæ, Pat., Bonon., Panorm., Gioen. Catan. et Divion. ex intim., Socc. Philom. Paris., Ital. Mut., Helvet., Socius. *Collingwood, near Hawkhurst, Kent.*
1843. April 6.			Heygate, James, M.D. *College-house, Derby.*
1843. Jan. 19.			Heywood, Sir Benjamin, Bart. 9 *Hyde-park-gardens; and Claremont, Manchester.*
1839. Feb. 7.			Heywood, James, Esq., F.S.A. *Athenæum Club; and Acresfield, Manchester.*
1820. Mar. 23.			Higman, Rev. John Philip, M.A. F.G.S. F.R.A.S. *Rectory, Fakenham, Norfolk.*
1839. Jan. 10.		†	Hilton, John, Esq. 10 *New Broad-street.*
1809. Dec. 21.			Hoare, Charles, Esq., F.S.A. 37 *Fleet-street.*
1814. May 19.			Hobhouse, Right Hon. Sir John Cam, Bart. M.A. 42 *Berkeley-square.*
1811. June 27.			Hoblyn, Thomas, Esq., F.L.S. *White Barns, Buntingford, Herts.*
1841. Feb. 18.	R.P.		Hodgkinson, Eaton, Esq., F.G.S. 14 *Salford-crescent, Manchester.*
1831. Apr. 14.			Hodgson, Joseph, Esq. *Birmingham.*
1830 June 20.		†	Hogg, John, Esq., M.A. F.L.S. F.C.P.S. M.R.S.L. 12 *King's-bench-walk, Inner Temple; and Norton-house, Stockton-upon-Tees.*
1837. Jan. 19.			Holland, Charles, M.D. 16 *Queen-street, May-fair.*
1815. Jan. 19.	P.		Holland, Henry, M.D. F.G.S. Coll. Reg. Med. Socius. 25 *Brook-street.*
1826. Feb. 2.			Holman, James, Esq., Lieut. R.N. F.L.S. *Windsor.*
1825. Apr. 21.	P.		Home, Sir Everard, Bart. Capt. R.N. F.S.A. 4 *Queen Anne-street.*
1843. Dec. 7.			Hood, Charles, Esq., F.R.A.S. *Earl-street, Blackfriars; and Camberwell.*
1847. Apr. 22.			Hooker, Joseph Dalton, M.D. *West-park, Kew.*
1812. Jan. 9.			Hooker, Sir William Jackson, K.H. LL.D. Hon. M.R.I.A. F.S.A. F.L.S. F.G.S. Acad. Cæs. Nat. Cur. Socius. *Kew.*
1834. June 5.		†	Hope, Rev. Frederick William, M.A. F.L.S. 56 *Upper Seymour-street.*

Date of Election.		
1837. June 1.	P.	† Hopkins, William, Esq., M.A. *Fitzwilliam-street, Cambridge.*
1841. May 20.		Hoppus, Rev. John, LL.D. Ph.D. Professor of Philosophy and Logic, University College, London. 39 *Camden-street, Camden-town.*
1834. Feb. 6.		Horne, James, Esq. *Clapham-common.*
1813. Nov. 11.	P.	Horner, Leonard, Esq., F.R.S.E. Soc. Sc. Harlem. Socius. *Rivermede, Hampton-wick.*
1828. Jan. 10.		† Horsfield, Thomas, M.D. F.L.S. F.G.S. M.R.A.S. Acad. Cæs. Nat. Cur. Socius. 43 *Markham-square, King's-road, Chelsea.*
1843. May 25.	P.	Hoskins, Samuel Elliott, M.D. *Guernsey.*
1821. Mar. 8.	P.	Howard, Luke, Esq. *Bruce-grove, Tottenham; and Ackworth-villa, Pomfret.*
1834. Apr. 10.		Hudson, Robert, Esq., F.G.S. *Clapham-common.*
1818. Jan. 8.		Hume, Joseph, Esq. 6 *Bryanston-square.*
1819. Nov. 11.		Hunt, Rev. George, M.A. F.S.A. *Egg Buckland, near Plymouth.*
1837. April 6.		† Hunter, Robert, Esq., F.G.S. F.S.A. *Highgate.*
1819. Nov. 18.		Hustler, Rev. James Devereux, B.D. *Euston-rectory, near Thetford, Norfolk.*
1829. Mar. 19.		Hutchinson, Lieut.-Colonel George, E.I.C. Beng. Engineers.
1844. Feb. 29.		† Hyett, William Henry, Esq. *Painswick-house, Painswick.*
1838. May 31.		Hymers, Rev. John, D.D. *St. John's College, Cambridge.*
1813. Mar. 4.		Inglis, Sir Robert Harry, Bart.—Vice-President.—D.C.L. Trust. Brit. Mus. Pres. Brit. Assoc. for the Advancement of Science, V.P.S.A. F.R.A.S. 7 *Bedford-square.*
1807. Apr. 23.		Jacob, William, Esq., Instit. Sc. Paris. Corresp. 31 *Cadogan-place, Sloane-street.*
1845. Apr. 3.		† Jackson, Colonel Julian. 52 *Coleshill-street, Pimlico.*
1826. May 25.		Jameson, Robert, Esq., Regius Professor of Natural History, Edinburgh. F.R.S.E. Hon. M.R.I.A. F.L.S. F.G.S. Acad. Reg. Sc. Neap.: Socc. Reg. Sc. Dan., Imp. Hist. Nat. Mosc., Hist. Nat. Veter. et Paris., Philom. Paris., Amer. Philad., Phil. et Hist. Nov.-Ebor., Socius.—Acad. Reg. Sc. Berol. Corresp. *Edinburgh.*
1841. Jan. 7.		† Jeffereys, Julius, Esq. 25 *A, Norfolk-crescent, Hyde-park.*
1840. April 2.		† Jeffreys, John Gwyn, Esq., F.L.S. *Norton, near Swansea.*
1841. Feb. 18.		† Jenkins, Sir Richard, G.C.B. *India House; and Bickton-hall, Shrewsbury.*
1821. Mar. 1.		Jennings, The Venerable Archdeacon, D.D. *Hampstead-green.*
1838. Mar. 15.		† Jervis, Thomas Best, Esq., Major E.I.C.E. F.L.S. F.G.S. F.R.A.S. *Clifton.*
1842. May 5.		† Jesse, John, Esq., F.R.A.S. F.L.S. *Frodsham, Cheshire.*
1842. Mar. 10.		† Johnson, Cuthbert William, Esq. 14 *Gray's-inn-square.*
1836. Mar. 10.	P.	† Johnson, Edward John, Esq. Captain R.N. 13 *Clement's-inn.*
1838. Jan. 18.		Johnson, Rev. George Henry Sacheverell, M.A. Professor of Moral Philosophy in the University of Oxford. *Oxford.*
1846. April 30.		† Johnson, Percival Norton, Esq., F.G.S. 38 *Mecklenburgh-square; and Ward-house, Tavistock.*
1810. Nov. 22.	P.	Johnston, Right Hon. Sir Alexander, Knt. F.S.A. V.P.R.A.S. 19 *Great Cumberland-place; and York-house, Twickenham.*
1845. June 5.		Johnston, Alexander Robert, Esq.
1837. June 15.		Johnston, James F. W., Esq., M.A. F.R.S. Ed. Professor of Chemistry and Mineralogy in the University of Durham. *Durham.*

Date of Election.			
1846. April 30.	P.		Jones, Henry Bence, M.A. M.D. Coll. Reg. Med. Socius. 30 *Lower Grosvenor-street, Grosvenor-square.*
1835. June 4.	P.	†	Jones, Thomas, Esq., F.R.A.S. 62 *Charing-cross; and West-square.*
1844. Mar. 21.		†	Jones, Thomas Rymer, Esq., Professor of Comparative Anatomy, King's College. *Colney-house, Finchley-common.*
1840. Apr. 30.	P.	†	Jones, Thomas Wharton, Esq. 35 *George-street, Hanover-square.*
1840. Nov. 19.	P.		Kater, Edward, Esq., F.G.S. M.R.I.A. *Mexborough, Yorkshire; and Athenæum Club.*
1846. Feb. 26.		†	Kay, Joseph Henry, Esq., Lieut. R.N.
1838. Dec. 6.		†	Kelland, Rev. Philip, M.A. F.R.S.E. M.C.P.S. Professor of Mathematics in the University of Edinburgh. *Wardie, near Edinburgh.*
1844. Feb. 29.		†	Kerigan, Thomas, Esq., R.N. 9 *St. Paul's-square, Southsea, Portsmouth.*
1822. Mar. 28.	P.		Kidd, John, M.D. Regius Professor of Medicine, and Aldrich's Professor of Anatomy, Oxford, F.L.S. F.G.S. Coll. Reg. Med. Socius. *Oxford.*
1834. Dec. 18.	C.P.		Kiernan, Francis, Esq. 30 *Manchester-street, Manchester-square.*
1824. Feb. 26.			King, Philip Parker, Esq. Captain R.N. F.L.S. *Dunheved, New South Wales.*
1818. Mar. 5.			Kirby, Rev. William, M.A. F.L.S. F.G.S. Acad. Cæs. Nat. Cur., et Soc. Nat. Scrutat. Berol. Socius. *Barham, near Ipswich.*
1830. Mar. 4.			Knowles, Sir Francis Charles, Bart. M.A.
1810. Jan. 18.	P.	*	König, Charles, Esq., K.H. Hon. M.R.I.A. Acad. Reg. Sc. Monach. Socius.—Acad. Imp. Sc. Petrop., et Soc. Reg. Gotting. Corresp.—Soc. Imp. Hist. Nat. Mosc. Socius.—Acad. Panorm., et Soc. Veterav., Sodalis. *British Museum.*
1843. Nov. 23.			Laing, Rev. David. 62 *Mornington-road, Regent's-park.*
1845. Dec. 19.		†	Lankester, Edwin, M.D. F.L.S. 22 *Old Burlington-street.*
1811. April 4.			Lansdowne, Henry, Marquis of, K.G. D.C.L. Trust. Brit. Mus. M.R.S.L. 52 *Berkeley-square; and Bowood-park, Wiltshire.*
1844. May 16.			Larcom, Thomas Aiskew, Capt. R.E.
1813. Nov. 11.			Lawrence, William, Esq. 18 *Whitehall-place.*
1840. May 21.		†	Lawson, Henry, Esq, 7 *Lansdowne-crescent, Bath.*
1815. Apr. 13.			Leake, Lieut.-Colonel William Martin, M.R.S.L. Acad. Reg. Sc. Berol. Socius Honor., Instit. Reg. Paris. Corresp. 50 *Queen-Anne-street.*
1843. May 11.		†	Le Couteur, Colonel John. *Belle-vue, Jersey.*
1831. Feb. 24.			Lee, John, LL.D. F.R.A.S. 5 *College, Doctors'-commons; and Hartwell-house, near Aylesbury, Buckinghamshire.*
1830. Mar. 25.	P.		Lee, Robert, M.D. Coll. Reg. Med. Socius. 4 *Saville-row.*
1820. Nov. 16.			Lefevre, John George Shaw, Esq., M.A. Vice-Chancellor of the University of London. *Board of Trade, Whitehall.*
1817. June 12.			Legh, Thomas, Esq., D.C.L. *Lyme-park, Cheshire.*
1822. May 23.			Lemon, Sir Charles, Bart. 46 *Charles-street, Berkeley-square; and Carclew, near Falmouth, Cornwall.*
1836. May 5.		†	Lewis, Thomas Locke, Esq. Capt. R.E. F.G.S. *Ibsley-cottage, Exeter.*
1846. June 18.		†	Liddell, John, M.D. *Greenwich Hospital.*
1811. Mar. 7.			Lincoln, John Kaye, Lord Bishop of. *Cambridge; and Buckden-palace, Huntingdonshire.*

Date of Election.		
1828. Jan. 17.	†	Lindley, John, Phil. D. F.L.S. Acad. Reg. Berol. Corresp.; Acad. Cæs. Nat. Cur., Socc. Physiogr. Lund., Linn. Holm., Socius.—Soc. Batav. Sc., Lyc. Nat. Hist. Nov.-Ebor., Socius Honor.—Prof. Bot. Univ. Coll. Lond. 21 *Regent-street.*
1832. Feb. 2.	P.	Lister, Joseph Jackson, Esq. *Upton, Essex.*
1841. May 13.	†	Liston, Robert, Esq. 5 *Clifford-street, New Bond-street.*
1836. Feb. 4.		Llewelyn, John Dillwyn, Esq., F.L.S. *Penllegare, Glamorgan.*
1818. Mar. 12.		Lloyd, Edward, Esq. Captain R.N. *United Service-club.*
1830. Mar. 11.	P.	Lloyd, Lieut.-Col. John Augustus, Surveyor-General. *Port Louis, Mauritius.*
1834. Apr. 10.		Lloyd, Rev. William Forster, M.A. *Missenden, Bucks.*
1836. Jan. 21.		Lloyd, Rev. Humphrey, D.D. M.R.I.A. *Dublin.*
1838. Feb. 22.	†	Locke, Joseph, Esq. 6 *Chester-terrace, Regent's-park.*
1811. Dec. 5.		Locker, Edward Hawke, Esq., F.S.A.
1810. July 5.		Lonsdale, William, Earl of. 14 *Carlton-terrace; and Lowther-castle, near Penrith.*
1841. Nov. 25.	†	Lovelace, William King, Earl of. *East Horseley-park, Ripley, Surrey; and Ashley-combe, Porlock, Somerset.*
1834. Dec. 18.	†	Lowe, George, Esq. 39 *Finsbury-circus.*
1829. Jan. 15.	R.P.	Lubbock, Sir John William, Bart. M.A. F.L.S. F.R.A.S. M.R.A.S. 23 *St. James's-place; and High Elms, Farnborough, Kent.*
1826. Feb. 2.	R.P.	Lyell, Charles, Esq., M.A. F.L.S. F.G.S. 11 *Harley-street, Cavendish-square.*
1826. Apr. 13.		Lyndhurst, John Singleton, Lord, D.C.L. 25 *George-street, Hanover-square.*
1840. Apr. 30.	†	Lyttelton, George William, Lord. 17 *St. James's-place; and Hagley-park, near Stourbridge, Worcestershire.*
1816. Mar. 14.		MacGrigor, Sir James, Bart., F.R.S.E. Coll. Reg. Med. Socius. 3 *Harley-street.*
1815. Apr. 13.		Mackenzie, Sir George Steuart, Bart. F.R.S.E. *Coul, Ross-shire.*
1827. June 14.		Mackinnon, William Alexander, Esq., M.A. F.S.A. F.G.S. 4 *Hyde-park-place; and Newton-park, Lymington, Hants.*
1831. Dec. 8.	P.	Maclear, Thomas, Esq., F.R.A.S. Astronomer Royal at the Cape of Good Hope.
1809. Jan. 19.		MacLeay, Alexander, Esq., F.L.S. Acad. Reg. Sc. Holm. Socius, et Acad. Reg. Sc. Taurin. Corresp. *Sydney, New South Wales.*
1839. May 30.	†	Mackmurdo, Gilbert Wakefield, Esq. *St. Thomas's Hospital; and 7 New Broad-street.*
1838. April 5.	†	Macneill, Sir John, F.R.A.S. M.R.I.A. 28 *Rutland-square, Dublin.*
1832. Feb. 2.	†	Madden, Sir Frederick, K.H. Hon. M.R.I.A. F.S.A. Soc. Reg. Antiq. Septen. Hafn. Socius. *British Museum.*
1817. June 12.		Maddy, Rev. John, D.D. F.S.A. F.R.A.S. *Somertown, Bury St. Edmunds.*
1819. June 24.		Magrath, Sir George, K.H. M.D. M.R.I.A. F.L.S. F.G.S. *Plymouth.*
1827. Mar. 22.	†	Mahon, Philip H., Viscount, D.C.L. PRESIDENT SOC. ANTIQ. 41 *Grosvenor-place; and Chevening-place, Kent.*
1847. Apr. 15.	†	Maitland, John Gorham, Esq., M.A. 8 *New-square, Lincoln's-inn.*
1839. Apr. 18.	†	Maitland, Rev. Samuel Roffy. *Lambeth-palace.*
1829. May 28.		Maitland, Ebenezer Fuller, Esq., F.S.A. *Henley-on-Thames, Oxfordshire.*
1821. June 28.	*	Majendie, Ashurst, Esq., F.G.S. *Hedingham-castle, Castle Hedingham, Essex.*
1831. May 12.		Manby, George William, Capt. R.N. *Yarmouth.*
1825. Jan. 20.		Mangles, James, Esq., Capt. R.N. 66 *Cambridge-terrace, Edgware-road.*

Date of Election.		
1825. Nov. 24.	P.	Mantell, Gideon Algernon, Esq., LL.D. F.L.S. F.G.S. Coll. Reg. Med. Socius, Soc. Philom. Paris. Corresp. Acadd. Philad. et Connect., Socius Honor. 19 *Chester-square, Pimlico.*
1836. Jan. 28.		Marcet, Francis, Esq. *Geneva.*
1816. Mar. 28.		Markland, James Heywood, Esq., F.S.A. *Bath.*
1819. May 13.		Marryatt, Frederick, Esq., Capt. R.N. *Wimbledon.*
1845. Feb. 13.		Martin, James Ranald, Esq., F.R.M. & C.S. M.R.A.S. 71 *A, Grosvenor-street.*
1823. Nov. 27.		Maskelyne, Anthony Mervin Story, Esq., M.A. *Basset-Down-house, Swindon.*
1846. Feb. 19.	†	Matheson, James, Esq. 13 *Cleveland-row.*
1832. Feb. 2.		Mauley, William Francis Spencer, Lord de. 24 *George-street, Hanover-square*; *and Canford-house, near Wimborne, Dorset.*
1829. Feb. 26.		Maxwell, Sir John, Bart. *Pollock, Renfrewshire.*
1827. Mar. 1.	†	Mayo, Rev. Charles, B.D. F.S.A. *Colesgrove, near Cheshunt, Hertfordshire.*
1828. Apr. 17.	†	Mayo, Herbert, Esq.
1835. June 4.	†	Mayo, Thomas, M.D. Coll. Reg. Med. Socius. 56 *Wimpole-street.*
1841. Feb. 25.	†	Melbourne, William, Viscount. 39 *South-street, Grosvenor-square*; *and Brocket-hall, Herts.*
1841. Jan. 14.	†	Melvill, James Cosmo, Esq. *East India House.*
1817. May 15.		Melville, Robert, Viscount, K.T. F.R.A.S. 3 *Somerset-place*; *and Melville-castle, Edinburgh.*
1838. May 3.	†	Merewether, Very Rev. John, D.D. Dean of Hereford, F.S.A. *Hereford.*
1843. Mar. 9.	†	Miers, John, Esq., F.L.S. *Temple Lodge, Hammersmith.*
1843. Mar. 30.	†	Miller, Joseph, Esq. *Monastery-cottage, East-India-road.*
1827. May 24.	P.	Miller, Lieut.-Colonel George, C.B.
1845. Feb. 6.	P.	Miller, William Allen, M.D. Professor of Chemistry, King's College, London. *King's College.*
1838. Feb. 8.		Miller, William Hallows, Esq. M.A. Professor of Mineralogy. *Cambridge.*
1836. Mar. 3.		Minto, Gilbert Elliot Murray Kynynmound, Earl of, G.C.B. F.R.A.S. *Minto-castle, Roxburghshire.*
1835. Nov. 26.		Molesworth, Sir William, Bart. 1 *Lowndes-square*; *and Pencarrow, Cornwall.*
1841. Apr. 29.	†	Monteagle of Brandon, Thomas, Lord, F.S.A. 37 *Lower Brook-street*; *and Exchequer office, Whitehall.*
1845. Feb. 13.	†	Monteith, Major-General William.
1836. June 16.		Montefiore, Sir Moses, Knt. 7 *Grosvenor-gate, Park-lane*; *and East Cliff-lodge, Ramsgate.*
1806. May 6.		Moor, Major Edward, F.S.A. M.R.A.S. *Bealings, near Woodbridge, Suffolk.*
1835. April 2.	†	Moore, George, Esq., F.S.A. F.L.S. 64 *Lincoln's-inn-fields.*
1846. Feb. 26.	†	Moore, Major John Arthur, F.S.A. 23 *Park-crescent, Portland-place*; *and Boyle-cottage, Thames Ditton.*
1827. Feb. 8.		Moreau, César, Esq., Acadd. Reg. Divion., Burd., et Masil., Socius. *Paris.*
1835. April 2.	†	Morgan, Arthur, Esq. 26 *New Bridge-street, Blackfriars.*
1832. Feb. 2.	†	Morgan, Octavius S., Esq. M.A. F.S.A. 70 *Pall-mall*; *and Tredegar-park, Monmouthshire.*
1819. Feb. 4.		Morier, James, Esq. 22 *Charles-street, Berkeley-square.*
1831. Mar. 10.		Morris, John Carnac, Esq. 9 *Upper Hyde-park-street.*

Date of Election.			
1842. Mar. 3.		†	Morison, Major-General William, C.B. F.R.S.E. *Oriental-club, and* 16 *Saville-row.*
1847. June 3.		†	Morpeth, George, Viscount. *Whitehall; and Castle Howard, Yorkshire.*
1839. Feb. 7.	P.	†	Moseley, Rev. Henry, M.A. *Wandsworth.*
1830. Feb. 18.			Moss, Joseph William, M.B. *Longdon, near Lichfield.*
1847. Apr. 22.		†	Mountcashel, Stephen, Earl of. *Moore-park, Kilworth, Cork.*
1822. Dec. 5.			Mudge, Rich. Zachariah, Esq., Lieut.-Col. R.E. *Beechwood, Plympton, Devon.*
1826. April 6.			Murchison, Sir Roderick Impey, G.C.St.S. M.A. Hon. Mem. R.S.Ed. R.I. Ac., and Cam. Phil. Soc. V.P.G.S. and R. Geogr. Soc., F.L.S. Acad. Imp. Sc. Petrop. Acad. Amer. Art. et Sc. Bost. Socius, Inst. Reg. Sc. Paris. et Acad. Reg. Taurin. Corresp., et Soc. Imp. Sc. Nat. Hist. Mosq. Socius., &c. &c. 16 *Belgrave-square.*
1826. Mar. 16.			Mylne, William Chadwell, Esq., F.R.A.S. *New-River-head.*
1820. May 18.		*	Napier, Henry, Esq., Capt. R.N. *Cadogan-place.*
1840. June 18.		†	Narrien, John, Esq., F.R.A.S., Professor of Mathematics in the Royal Military College, Sandhurst. *Sandhurst.*
1814. May 5.			Neave, Sir Thomas, Bart. F.S.A. 6 *Albemarle-street; and Dagenham-park, Rumford, Essex.*
1846. Jan. 15.			Neilson, James B., Esq. *Glasgow.*
1842. Jan. 6.	P.		Newbold, Thomas John, Esq., Lieut. E.I.C.S. *Madras.*
1846. Mar. 26.	R.P.	†	Newport, George, Esq., F.L.S. F.R.C.S. Soc. Philom. Paris. Corresp. Hon. Fel. Mem. Am. Agri. Assoc. New York. 30 *Southwick-street, Oxford-terrace.*
1833. Feb. 7.		†	Nolan, Rev. Frederick, LL.D. M.R.S.L. *Prittlewell, Essex.*
1842. Dec. 15.			Norfolk, Henry George, Duke of. 1 *Hyde-park-place.*
1830. May 27.			Northampton, Spencer Joshua Alwyne, Marquis of.—PRESIDENT.—Trust. Brit. Mus. F.S.A. Hon. M.R.I.A. F.L.S. F.G.S. 145 *Piccadilly; and Castle Ashby, Northampton.*
1818. Apr. 9.			Northumberland, Algernon, Duke of,—VICE-PRESIDENT.—F.S.A. *Northumberland-house; and Alnwick-castle.*
1840. June 4.		†	Norwich, Edward Stanley, Lord Bishop of, President of the Linnean Society. 38 *Lower Brook-street; and Palace, Norwich.*
1826. Feb. 2.		†	Ogle, James Adey, M.D. F.R.A.S. Coll. Reg. Med. Socius. Lord Lichfield's, and Aldrich's Professor of Medicine; *Oxford.*
1835. June 4.			Oliveira, Benjamin, Esq., F.S.A. 8 *Upper Hyde-park-street.*
1824. Mar. 4.			Orford, Horatio, Earl of. *White's Club; and Wolterton-park, Norfolk.*
1819. Feb. 25.			Ormerod, George, Esq., D.C.L. F.S.A. F.G.S. *Sudbury-park, Gloucestershire.*
1843. Mar. 16.		†	O'Shaughnessy, William Brooke, Esq., M.D. *Calcutta.*
1838. May 3.	P.		Outram, Benjamin Fonseca, M.D. F.R.G.S. 1 *Hanover-square.*
1834. Dec. 18.	R.P.		Owen, Richard, Esq., M.D. LL.D. F.L.S. V.P.G.S. Instit. Sc. Paris. Corresp. Fellow and Hunterian Professor of Anatomy and Physiology in the Royal College of Surgeons of England. *Royal College of Surgeons, Lincoln's-inn-fields.*
1845. Dec. 18.		†	Oxford, Samuel Wilberforce, Lord Bishop of. 61 *Eaton-place.*
1821. Nov. 15.	P.		Palgrave, Sir Francis, K.H. Deputy Keeper of Her Majesty's Records. *Rolls'-yard, Chancery-lane; and Hampstead-green.*

Date of Election.			
1821. June 21.		*	Paris, John Ayrton, M.D. President of the Royal College of Physicians. 27 *Dover-street.*
1824. Mar. 4.	P.		Parish, Sir Woodbine, K.C.H. F.S.A. F.G.S.
1815. June 1.			Parker, Thomas Lister, Esq., F.S.A. 34 *Mount-street.*
1812. Feb. 20.	P.		Parry, Charles Henry, M.D. *Bath.*
1821. Feb. 15.	P.		Parry, Sir William Edward, Knt. D.C.L. Capt. R.N. Hon. M.R.I.A. F.R.A.S. Acad. Imp. Sc. Petrop. Socius, Inst. Reg. Sc. Paris. Corresp. *Superintendent of Haslar Hospital, Gosport.*
1837. Feb. 23.		†	Partridge, Richard, Esq. 17 *New-street, Spring-gardens.*
1816. Mar. 7.			Pasley, Major-General Sir Charles William, R.E. C.B. F.R.A.S. F.G.S. 12 *Norfolk-crescent, Hyde-park.*
1818. Jan. 29.			Peacock, Very Rev. George, D.D. Dean of Ely, F.G.S. F.R.A.S. *Deanery, Ely.*
1833. Dec. 5.			Pearson, Sir Edwin, K.H. M.A. 5 *Gloucester-terrace, Regent's-park.*
1826. Mar. 9.			Pearson, Sir William, Knt. M.D.
1832. Feb. 2.			Pechell, Sir Samuel John Brooke, Bart. Capt. R.N. 27 *Hill-street, Berkeley-square.*
1822. Dec. 5.			Peel, Right Hon. Sir Robert, Bart. D.C.L. Trust. Brit. Mus. F.S.A. *Whitehall-gardens; and Drayton-Manor, Fazeley, Staffordshire.*
1835. April 2.		†	Pelly, Sir John Henry, Bart. *Trinity-house.*
1813. Feb. 11.			Pemberton, George, Esq. *Bainbridge Holme, Durham; and* 20 *Edgeware-road.*
1827. May 24.			Pendarves, Edward William Wynne, Esq., M.A. F.G.S. 36 *Eaton-place, Belgrave-square; and Pendarves, Truro, Cornwall.*
1824. Nov. 18.			Penn, Richard, Esq. 6 *Whitehall.*
1808. Jan. 28.	P.		Pepys, William Hasledine, Esq., F.L.S. 22 *Poultry.*
1847. Apr. 22.		†	Percy, John, M.D. *Birmingham.*
1838. May 3.		†	Pereira, Jonathan, M.D. F.L.S. 47 *Finsbury-square.*
1807. Dec. 10.			Petit, Louis Hayes, Esq., M.A. F.S.A. F.L.S. F.G.S. F.R.A.S. M.R.S.L. 9 *New-square, Lincoln's-inn.*
1817. Mar. 6.			Petre, William Francis Henry, Lord. 3 *Mansfield-street; and Thorndon-hall, near Brentwood, Essex.*
1827. Feb. 1.		†	Pettigrew, Thomas Joseph, Esq., F.S.A. M.R.A.S. Univ. Gotting. Phil. Doct.—Acad. Reg. Divion. Socius. 8 *Saville-row.*
1826. Apr. 11.	P.		Philip, Alexander Philip Wilson, M.D. Coll. Reg. Med. Socius. F.R.S.E.
1840. Feb. 13.		†	Phillimore, Joseph, LL.D. 15 *College, Doctors'-commons; and* 22 *Portman-street.*
1819. Jan. 29.			Phillipps, Sir Thomas, Bart. M.A. F.S.A. F.G.S. Hon. M.R.S.L. *Middle-hill, Worcestershire.*
1834. Dec. 18.			Phillips, Benjamin, Esq. 17 *Wimpole-street, Cavendish-square.*
1834. Apr. 10.		†	Phillips, John, Esq., F.G.S. *York.*
1822. Mar. 14.	P.	*	Phillips, Richard, Esq., F.R.S.E. 6 *Craig's-court, Charing-cross; and* 2 *Champion-place, Grove-lane, Camberwell.*
1847. Apr. 15.		†	Plowden, William Henry Chicheley, Esq., F.R.A.S. 8 *Devonshire-place.*
1829. April 9.			Pole, William, Esq. M.A. 66 *Brook-street.*
1816. Feb. 29.			Pollock, The Right Hon. Sir Frederick, Chief Baron of the Exchequer, K.H. M.A. F.S.A. F.G.S. *Queen-square-house, Guildford-street.*

Date of Election.		
1838. Jan. 18.	†	Porter, George Richardson, Esq., M.R.A.S. Instit. Reg. Sc. Paris. Corresp. *Board of Trade, Whitehall.*
1837. June 8.		Portlock, Joseph Ellison, Esq., Capt. R.E. F.G.S. *Cork.*
1824. May 13.	P.	Powell, Rev. Baden, M.A. F.R.A.S. Savilian Professor of Geometry, Oxford. *Oxford.*
1842. Jan. 27.	†	Pratt, Samuel Peace, Esq., F.L.S. F.G.S. 55 *Lincoln's-inn-fields.*
1827. Feb. 8.		Prichard, James Cowles, M.D. Hon. M.R.I.A. Instit. Reg. Sc. Paris. Corresp. 1 *Woburn-place, Russell-square.*
1840. Feb. 6.	†	Pritchard, Rev. Charles, M.A. *Clapham.*
1819. Mar. 11.	C.P.*	Prout, William, M.D. Coll. Reg. Med. Socius. 40 *Sackville-street.*
1830. May 27.		Pusey, Philip, Esq. 35 *Grosvenor-square; and Pusey-house, near Faringdon, Berks.*
1844. Feb. 29.	†	Quain, Richard, Esq. Professor of Anatomy, University College, London. 23 *Keppel-street.*
1814. Dec. 15.		Rashleigh, William, Esq., F.L.S. 3 *Cumberland-terrace, Regent's-park; and Menabilly-house, Foy, Cornwall.*
1837. Jan. 19.	†	Rastrick, John Urpath, Esq. 46 *Eaton-square.*
1838. Feb. 8.		Reade, Rev. Joseph Bancroft, M.A. *Stone Vicarage, Aylesbury.*
1843. Feb. 2.	P.	Rees, George Owen, M.D. F.G.S. Coll. Reg. Med. Socius. 59 *Guildford-street, Russell-square.*
1817. June 12.		Reeves, John, Esq., F.L.S. F.R.A.S. *Clapham.*
1834. Feb. 6.		Reeves, John Russell, Esq., F.L.S. *Clapham.*
1839. Feb. 21.	†	Reid, Lieut.-Colonel William, C.B. R.E. Governor of Jamaica.
1843. Feb. 23.	†	Rendel, James Meadows, Esq. 8 *Great George-street, Westminster.*
1822. Mar. 21.		Rennie, George, Esq.—VICE-PRESIDENT AND TREASURER.—Hon. M.R.I.A. Acad. Reg. Taurin. Corresp. 21 *Whitehall-place.*
1823. June 12.	P.	Rennie, Sir John, Knt. President of the Institution of Civil Engineers. 15 *Whitehall-place.*
1845. May 22.		Rennie, James, Esq. 6 *Whitehall-place.*
1825. Feb. 24.		Richardson, Sir John, Knt. M.D. F.L.S. Acad. Sc. Nat. Philad., Georg. Paris. Corresp. —Socc. Hist. Nat. Montreal, Lit. et Phil. Quebec, Hist. Nat. Boston, Socius Honor. *Haslar-hospital, Gosport.*
1840. April 2.	†	Richmond, Charles Gordon Lennox, Duke of, K.G. President of the Royal Agricultural Society. 51 *Portland-place; and Goodwood, near Petworth, Sussex.*
1820. Mar. 23.		Ricketts, Charles Milner, Esq., F.G.S. *Lima.*
1842. Jan. 13.		Riddell, Charles James Buchanan, Esq., Capt. R.A. *Woolwich.*
1839. Apr. 25.	P.	Rigg, Robert, Esq. *Greenford, Middlesex.*
1828. Apr. 17.		Ripon, Frederick John, Earl of. *Carlton-gardens.*
1836. Feb. 11.		Robertson, Archibald, M.D. *Northampton.*
1796. Nov. 17.		Rogers, Samuel, Esq., F.S.A. 22 *St. James's-place.*
1839. Dec. 5.		Rogers, John, jun. Esq. *Vine-lodge, near Sevenoaks, Kent.*
1815. Mar. 16.	P.	Roget, Peter Mark, M.D.—SECRETARY.—F.G.S. F.R.A.S. V.P.S.A. Coll. Reg. Med. Socius. Corresp., et Acad. Reg. Scient. Taurin. 18 *Upper Bedford-place, Russell-square.*
1844. Feb. 1.	†	Ronalds, Francis, Esq. *Chiswick.*

Date of Election.		
1831. June 9.		Ros, Hon. I. Frederick F. de, Capt. R.N. F.R.A.S.
1834. June 5.		Rose, Sir George, Knt. 4 *Hyde-park-gardens.*
1819. April 1.		Rosebery, Archibald John, Earl of, K.T. 139 *Piccadilly; and Dalmeney-park, Linlithgow.*
1822. June 13.		Ross, Captain Daniell. *India.*
1828. Dec. 11.	P.	Ross, Sir James Clark, Knt. Capt. R.N. D.C.L. F.L.S. F.R.A.S. Soc. Reg. Sc. Hafn. Socius. *Aston House, Aston Abbots, Aylesbury.*
1831. Dec. 8.	P.	Rosse, William, Earl of, F.R.A.S. *Birr-castle, King's-county, Ireland.*
1839. Dec. 12.	†	Roupell, George Leith, M.D. 15 *Welbeck-street.*
1837. April 6.	†	Royle, John Forbes, M.D. F.L.S. F.G.S. F.R.A.S. Professor of Materia Medica and Therapeutics, King's-college. 4 *Bulstrode-street, Manchester-square.*
1847. Feb. 18.	†	Rudge, Edward John, Esq., M.A. F.S.A. 52 *Upper Harley-street; and Manor Abbey-house, Eversham.*
1821. June 7.		Russell, Jesse Watts, D.C.L. F.S.A. F.L.S. F.G.S. *Ilam-hall, Staffordshire.*
1847. May 6.	†	Russell, Lord John. *Chesham-place, Belgrave-square.*
1818. Apr. 16.	C.P.	Sabine, Lieut.-Colonel Edward, R.A.—Foreign Secretary.—F.R.A.S. Acadd. Imp. Sc. Petrop., Reg. Sc. Taur., Corresp., Brux., Norv. Phil. et Œcon. Siles. Socius: Socc. Reg. Sc. Gotting., Soc.: Vaud., Mem. National Inst. Washington U.S. et Geogr. Paris., Corresp.—Mem. of Royal Batavian Soc. *Athenæum Club; and Woolwich.*
1832. Dec. 6.		Sandford, Edward Ayshford, Esq. *Nynehead, Somerset.*
1833. Apr. 18.	†	Saunders, Rev. Augustus Page, D.D. *Charterhouse-school.*
1822. June 27.		Sawbridge, Henry Barne, Esq.
1824. June 17.	P.	Scoresby, Rev. William, D.D. F.R.S.E. Instit. Reg. Sc. Paris. Corresp. Vicar of Bradford, Yorkshire. *Bradford.*
1800. Jan. 16.		Scott, John Corse, Esq. *Edinburgh.*
1826. Dec. 7.		Scrope, George Poulett, Esq., F.G.S. 13 *Belgrave-square; and Castle Combe, Chippenham, Wiltshire.*
1824. Jan. 15.	†	Scudamore, Sir Charles, Knt. M.D. 6 *Wimpole-street.*
1821. Feb. 1.		Sedgwick, Rev. Adam, M.A. Hon. M.R.I.A. F.G.S. F.R.A.S. Woodwardian Lecturer. *Cambridge.*
1831. Jan. 13.		Selkirk, Thomas James, Earl of. *St. Mary's Isle, Kirkcudbright.*
1841. June 17.	†	Seymour, Edward James, M.D. Coll. Reg. Med. Socius. 13 *Charles-street, Berkeley-square.*
1840. May 7.	†	Sharp, William, Esq., F.G.S. F.R.A.S. *Rugby.*
1839. May 9.		Sharpey, William, M.D. F.R.S.E. Professor of Anatomy in University-college. 35 *Gloucester-crescent, Regent's-park.*
1831. Apr. 21.		Shee, Sir Martin Archer, Knt. President of the Royal Academy. 32 *Cavendish-square.*
1830. April 1.		Sheepshanks, Rev. Richard, M.A. F.G.S. F.R.A.S. 14 *London-road, Reading.*
1824. Mar. 11.		Shuckburgh, Sir Francis, Bart. *Pavilion, Hans-place, Chelsea; and Shuckburgh-park, Warwickshire.*
1841. Mar. 4.	†	Sievier, Robert William, Esq. R.A. 12 *A, Henrietta-street, Cavendish-square.*
1845. Jan. 9.	P.	Simon, John, Esq., Demonstrator of Anatomy, King's College. 3 *Lancaster-place.*

Date of Election.			
1847. Apr. 22.		†	Simpkinson, Sir John Augustus Francis, Knt., M.A. Q.C. F.S.A. 21 *Bedford-place.*
1837. Apr. 20.	P.	†	Skey, Frederic Carpenter, Esq. 13 *Grosvenor-street.*
1841. June 10.			Smee, Alfred, Esq. 7 *Finsbury-circus.*
1824. May 14.			Smith, Lieut.-Col. Charles Hamilton, F.L.S. *Plymouth.*
1830. Dec. 23.			Smith, James, Esq., F.R.S.E. *Jordan-hill, near Glasgow.*
1837. June 1.			Smith, John T., Esq., Capt. Madras Engineers. *Madras.*
1840. Jan. 9.		†	Smith, Rev. John Pye, D.D. LL.D. F.G.S. Prof. Div. and President of the Protestant Dissenting College, Homerton. *Homerton, Middlesex.*
1803. May 10.			Smith, John Spenser, Esq., F.S.A. *Caen, Normandy.*
1819. Nov. 25.			Smith, Joseph, Esq., F.L.S. 2 *Gray's-inn-place.*
1806. Feb. 13.			Smith, Sir William, Knt.
1841. Nov. 18.		†	Smith, Sir J. M. Frederic, Lieut.-Colonel, R.E. *Chatham.*
1826. June 15.	P.		Smyth, William Henry, Esq., Capt. R.N. K.S.F. D.C.L. Hon. M.R.I.A. Director S.A. V.P.R.A.S.—V.P.R.E. Instit. Reg. Sc. Paris. Corresp., Acadd. Sc. Neap., Panorm. et Flor., Socius, Hon. Mem. Acad. of Sciences Boston, Corresp. Mem. National Inst. Washington and Naval Lyceum of New York. 3 *Cheyne-walk, Chelsea.*
1843. Jan. 19.		†	Solly, Edward, Esq., Professor of Chemistry, Horticultural Society, F.L.S. 33 *Bedford-place, Russell-square.*
1807. May 7.		*	Solly, Richard Horsman, Esq., M.A. F.S.A. F.L.S. F.G.S. 48 *Great Ormond-street.*
1837. Jan. 19.		†	Solly, Samuel, Esq. 1 *St. Helen's-place, Bishopsgate-street.*
1823. May 29.			Solly, Samuel Reynolds, Esq., M.A. F.S.A. F.G.S. *Surge-hill, King's Langley, Herts.*
1797. Mar. 9.			Somerset, Edward Adolphus, Duke of, K.G. D.C.L. F.S.A. F.L.S. *Park-lane.*
1817. Dec. 11.			Somerville, William, M.D. F.R.S.E. F.L.S. F.G.S. 45 *Chester-square.*
1845. June 5.			Sopwith, Thomas, Esq., F.G.S. *Allenheads, Haydon-bridge, Northumberland.*
1821. Feb. 15.	C.P.		South, Sir James, Knt. F.R.S.E. Hon. M.R.I.A. F.L.S. F.R.A.S. Acadd. Imp. Sc. Petrop. et Reg. Sc. Brux. Socius. *The Observatory, Camden-hill, Kensington.*
1825. Apr. 14.			Southey, Henry Herbert, M.D. D.C.L. Coll. Reg. Med. Socius. 1 *Harley-street.*
1834. Apr. 10.		†	Spence, William, Esq., F.L.S. Soc. Linn. Holm. Soc. 18 *Lower Seymour-street.*
1844. Feb. 1.		†	Stanford, John Frederick, Esq., M.A. *Foley-house, Portland-place.*
1807. Jan. 8.		*	Stanhope, Philip Henry, Earl. *Chevening-place, Kent.*
1816. June 27.			Stanhope, John Spencer, Esq.
1830. Mar. 11.			Stanley, Edward, Esq. 23 *A, Brook-street.*
1790. Apr. 29.			Stanley, John Thomas, Lord, F.S.A. 40 *Dover-street, Piccadilly.*
1842. Mar. 3.			Stanley, Owen, Esq., Capt. R. N., in command of H.M. Surveying Ship Rattlesnake.
1803. Apr. 28.			Staunton, Sir George Thomas, Bart. D.C.L. F.S.A. F.L.S. 17 *Devonshire-street, Portland-place.*
1845. Apr. 3.		†	Stebbing, Rev. Henry, D.D. F.R.B.S. *Residence, St. James's-chapel, Hampstead-road.*
1832. Apr. 5.		†	Stephens, Archibald John, Esq., M.A. 61 *Chancery-lane.*

Date of Election.			
1829. Jan. 15.			Steuart, John Robert, Esq., M.R.A.S.
1811. Nov. 21.			Stevenson, William Ford, Esq., F.S.A. *Grande-rue, Passy, near Paris.*
1838. May 3.			Stirling, Edward Hamilton, Esq. *Calcutta.*
1821. Jan. 18.			Stokes, Charles, Esq., F.S.A. F.L.S. F.G.S. F.R.A.S. 4 *Verulam-buildings, Gray's-inn.*
1810. June 7.			Stracey, Sir Edward, Bart. LL.D. *Rackheath-hall, Norfolk.*
1825. Feb. 3.			Strangford, Percy Clinton, Sydney, Viscount, G.C.B. G.C.H. D.C.L. F.S.A. 68 *Harley-street.*
1821. Mar. 8.			Strangways, Hon. William Thomas Horner Fox. 31 *Old Burlington-street; and Abbotsbury, Dorsetshire.*
1832. June 7.		†	Stratford, William Samuel, Esq., Lieut. R.N. F.R.A.S. Superintendent of the Nautical Almanac. 6 *Notting-hill-square, Kensington.*
1846. June 18.			Sutherland, Alexander John, Esq., M.D. Coll. Reg. Med. Socius, Senior Physician to St. Luke's Hospital, F.G.S. M.R.C.S. 1 *Parliament-street.*
1828. Mar. 13.			Sutherland, Alexander Robert, M.D. Coll. Reg. Med. Socius, F.G.S. 1 *Parliament-street; and Torquay.*
1820. Dec. 14.			Swainson, William, Esq., F.L.S. Soc. Hist. Nov.-Ebor. Socius.—Soc. Hist. Nat. Paris. Corresp. *New Zealand.*
1839. Mar. 14.		†	Swanston, Clement Tudway, Esq., F.S.A. 51 *Chancery-lane.*
1818. Feb. 26.			Swinburne, Sir John Edward, Bart. F.S.A. 18 *Grosvenor-place.*
1834. Feb. 6.	P.	†	Sykes, Lieut.-Colonel William Henry.—Vice-President.—Hon. M.R.I.A. F.G.S. M.R.A.S. 47 *Albion-street, Hyde-park.*
1839. Apr. 25.		†	Sylvester, James Joseph, Esq., M.A. F.R.A.S. 26 *Lincoln's-inn-fields.*
1835. June 4.		†	Symonds, Sir William, K.H. Capt. R.N. 4 *Somerset-place.*
1813. May 6.			Talbot, Charles Chetwynd, Earl, K.P. F.S.A. *Ingestrie-hall, near Stafford; and* 10 *Great George-street.*
1831. Mar. 17.			Talbot, Christopher Rice Mansel, Esq. *Margam, Glamorganshire.*
1831. Mar. 17.	Rm. R.P.		Talbot, William Henry Fox, Esq., F.L.S. *Lacock-abbey, near Chippenham.*
1835. Feb. 5.		†	Tattam, Very Rev. Archdeacon, D.D. M.A. M.R.S.L. *Bedford.*
1845. Nov. 20.		†	Taylor, Alfred Swaine, Esq., Lecturer on Chemistry and Medical Jurisprudence at Guy's Hospital. 3 *Cambridge-place, Regent's-park.*
1825. May 5.			Taylor, John, Esq., Treas. G.S. F.L.S. *Sheffield-house, Church-street, Kensington.*
1842. Feb. 10.			Taylor, Thomas Glanville, Esq., F.R.A.S. Astronomer to the East India Company. *Madras.*
1836. Jan. 21.		†	Taylor, Rev. William. 77 *Westbourne-terrace, Hyde-park.*
1834. June 5.			Teignmouth, Charles John, Lord, D.C.L. 19 *Portland-place.*
1833. Dec. 5.			Terry, Charles, Esq., F.S.A.
1845. June 19.			Thesiger, Sir Frederick, Knt. 11 *Bryanston-square; and* 2 *King's-bench-walk, Temple.*
1846. Jan. 22.		†	Thompson, Theophilus, M.D. 3 *Bedford-square.*
1828. Nov. 20.			Thompson, Lieut.-Colonel Thomas Perronet, M.A. *Eliot-vale, Blackheath.*
1821. Dec. 20.			Thomson, James, Esq., F.L.S. *Primrose, near Clitheroe.*
1811. Mar. 28.	P.		Thomson, Thomas, M.D., Regius Professor of Chemistry, Glasgow, Hon. M.R.I.A. F.R.S.E. F.L.S. F.G.S. *Glasgow.*

Date of Election.		
1810. June 7.		Thornton, Right Hon. Sir Edward, G.C.B. *Wembury-house, Plymouth.*
1834. Apr. 10.	†	Thornton, Henry Sykes, Esq., M.A. *Battersea-rise, Surrey.*
1839. May 30.	†	Thorp, The Venerable Charles, D.D. Archdeacon of Durham and Warden of the University of Durham. *Durham.*
1841. Feb. 25.	†	Tierney, Rev. Mark Aloysius. *Arundel, Sussex.*
1835. April 2.		Tite, William, Esq., F.S.A. 25 *Upper Bedford-place, Russell-square.*
1838. Feb. 8.	†	Todd, Robert Bentley, M.D. Coll. Reg. Med. Socius, Professor of Physiology and General Anatomy, King's College, London. 3 *New-street, Spring-gardens.*
1821. Mar. 21.		Tooke, Thomas, Esq. 31 *Spring-gardens.*
1818. Mar. 12.		Tooke, William, Esq., M.R.S.L. 12 *Russell-square.*
1818. Dec. 17.	*	Torrens, Lieut.-Colonel Robert. *Reform Club, Pall-mall.*
1842. Nov. 17.		Towneley, Charles, Esq. 3 *Tilney-street, Park-lane.*
1822. Nov. 7.		Townley, George, Esq. 5 *L, Albany.*
1842. Mar. 10.	P.	Toynbee, Joseph, Esq. 12 *Argyll-place.*
1823. May 29.		Traherne, Rev. John Montgomery, M.A. F.S.A. F.L.S. F.G.S. *St. Hilary, near Cowbridge, Glamorganshire.*
1815. Nov. 16.		Travers, Benjamin, Esq., President of the Royal College of Surgeons of England. 12 *Bruton-street.*
1822. Nov. 14.		Tulk, Charles Augustus, Esq., F.S.A. *Totteridge-park, Herts.*
1843. May 18.		Tulloch, James, Esq., F.S.A. F.L.S. 16 *Montague-place, Bedford-square.*
1845. Apr. 10.	†	Tupper, Martin Farquhar, Esq., D.C.L. *Albury, Guildford, Surrey.*
1817. June 5.		Turnbull, Peter Evan, Esq., F.S.A. *Newport, Isle of Wight.*
1831. Mar. 17.		Turnbull, Rev. Thomas Smith, M.A. F.G.S. *Blofield, Norfolk.*
1821. May 24.		Turner, Charles Hampden, Esq., F.L.S. F.G.S. 15 *Bruton-street; and Rook's-nest-park, Godstone, Surrey.*
1802. Dec. 9.		Turner, Dawson, Esq., Hon. M.R.I.A. F.S.A. F.L.S. M.R.S.L. Acadd. Cæs. Nat. Cur. et Reg. Sc. Holm. Socius. *Athenæum Club; and Great Yarmouth.*
1839. May 9.	P. †	Turnor, Rev. Charles, M.A. F.S.A. F.R.A.S. *Cheltenham.*
1838. Apr. 5.	†	Tuson, Edward William, Esq., F.L.S. 74 *Harley-street.*
1838. Feb. 8.	†	Tweedie, Alexander, M.D. Coll. Reg. Med. Socius. 30 *Montague-place, Bedford-square.*
1834. June 5.		Twining, Richard, Esq. 13 *Bedford-place, Russell-square.*
1838. Mar. 15.	†	Twiss, Travers, Esq., D.C.L. F.G.S. 5 *B, Albany, Piccadilly.*
1820. Apr. 13.		Tylden, Lieut.-Colonel Sir John Maxwell, Knt. *Milsted, Kent.*
1821. Dec. 13.	P.	Ure, Andrew, M.D. F.R.A.S. 24 *Bloomsbury-square.*
1813. June 24.		Vaughan, William, Esq. 70 *Fenchurch-street.*
1830. May 6.		Veitch, Capt. James, R.E. F.G.S. Corresp. Mem. Natt. Inst. Washington, U.S. *Truro.*
1823. Jan. 9.		Vivian, John Henry, Esq., F.G.S. 2 *Upper Belgrave-square; and Swansea, Glamorganshire.*
1826. June 8.		Vyvyan, Sir Richard Rawlinson, Bart. *Trelowarren, Helstone, Cornwall.*
1828. Apr. 17.	P.	Walker, James, Esq., F.R.S.E. 23 *Great George-street, Westminster.*
1831. Mar. 3.		Walker, Rev. Robert, M.A. Reader in Experimental Philosophy in the University of Oxford. *Wadham College, Oxford.*
1830. April 1.		Wall, Charles Baring, Esq., M.A. F.S.A. M.R.S.L. 44 *Berkeley-square*; *and Norman-court, near Stockbridge, Hampshire.*

Date of Election.		
1829. Mar. 12.		Wallich, Nathaniel, M. et Ph.D. F.R.S.E. F.L.S. F.G.S. M.R.A.S. Instit. Reg. Sc. Paris., et Acad. Reg. Sc. Berolin., Corresp.—Soc. Reg. Sc. Hafn. Socius. 5 *Upper Gower-street, Bedford-square.*
1819. Nov. 11.		Walter, Rev. Henry, B.D. *Hasilbury Brian, Dorsetshire.*
1837. May 25.	†	Walton, Rev. William, M.A. *Allenheads, Northumberland.*
1809. Feb. 16.		Warburton, Henry, Esq., M.A. 45 *Cadogan-place, Sloane-street.*
1817. May 1.		Warre, John Ashley, Esq. 54 *Lowndes-square, Sloane-street.*
1830. Dec. 9.	P.	Warren, Rev. John, M.A. *Graveley, Cambridgeshire.*
1835. April 2.	†	Warren, Samuel, Esq. *Inner Temple; and* 35 *Woburn-place.*
1815. June 8.		Warrender, Right Hon. Sir George, Bart. F.R.S.E. *Clifden, Bucks.*
1845. Feb. 13.	†	Washington, John, Esq., Capt. R.N. F.G.S. M.R.G.S. A.I.C.E. Socc. Reg. Sc. Hafn. Soc. Geog. Berol., et Paris. Socius. 24 *Chester-terrace, Regent's-park.*
1834. Feb. 6.		Waterhouse, John, jun., Esq. *Halifax, Yorkshire.*
1818. Nov. 12.		Watson, Sir Frederick Beilby, K.C.H. F.S.A. 4 *Albany-terrace, New-road.*
1820. Dec. 7.		Watt, James, Esq. *Aston-hall, Birmingham.*
1827. May 24.	†	Wavell, Major-General Arthur Goodall, K.F. K.C.S.
1826. Mar. 9.	P.	Weaver, Thomas, Esq., M.R.I.A. F.G.S. 16 *Stafford-row, Pimlico; and Woodlands, Wrington.*
1822. Mar. 21.		Webb, Frederick, Esq., F.S.A.
1844. Mar. 7.		Webster, John, M.D. Coll. Reg. Med. Socius. 24 *Brook-street, Grosvenor-square.*
1847. Mar. 18.	†	Webster, Thomas, Esq., M.A. 22 *Chester-square.*
1847. Nov. 25.	†	Wellington, Arthur, Duke of, Field Marshal, K.G. *Apsley-house, Piccadilly; and Strathfieldsaye.*
1846. Feb. 19.	†	West, William, Esq. *Highfield-house, Leeds.*
1837. May 25.	†	Westmacott, Richard, Esq., F.G.S. 21 *Wilton-place, Belgrave-square.*
1814. June 9.		Weyland, John, Esq. 52 *Charles-street, Berkeley-square; and Woodrising-hall, Norfolk.*
1829. June 4.		Wharncliffe, Lord, B.A. *Wortley-hall, Sheffield; and Belmont-castle, Dundee.*
1840. Jan. 9.		Whatman, James, jun., Esq. *Vinters, near Maidstone, Kent.*
1836. Jan. 21.	R.P. †	Wheatstone, Charles, Esq., Professor of Experimental Philosophy, King's College, London, Instit. Reg. Sc. Paris. Corresp. *Lower-mall, Hammersmith.*
1820. Apr. 13.	R.P.	Whewell, Rev. William, B.D. Hon. M.R.I.A. F.S.A. F.G.S. F.R.A.S. Master of Trinity College, Cambridge. *Lodge, Cambridge.*
1837. Apr. 13.	†	White, William Archibald Armstrong, Esq., F.S.A. 14 *College-street, Westminster.*
1842. Dec. 22.	†	Widdrington, Samuel E., Esq., Capt. R.N. *Newton-hall, Felton, Northumberland.*
1835. April 2.	†	Wigram, Right Hon. Sir James, Knt. M.A. F.S.A. 68 *Portland-place.*
1821. Mar. 8.		Wilbraham, George, Esq. *Delamere-house, Northwich, Cheshire.*
1834. Dec. 18.		Wilkinson, Sir John Gardner, Knt. 34 *Conduit-street.*
1835. April 2.	†	Williams, Charles James Blasius, M.D. Coll. Reg. Med. Socius, Professor of Physic in University College, London. 7 *Holles-street, Cavendish-square.*
1828. Mar. 6.		Williams, John, Esq., F.L.S. *Scorrier-house, near Redruth, Cornwall.*
1830. Apr. 22.		Willis, Rev. Robert, M.A. F.G.S. Jacksonian Professor of Natural and Experimental Philosophy. *Cambridge.*
1838. Mar. 1.	†	Wilson, Alexander, Esq. 34 *Bryanston-square.*

Date of Election.		
1845. Feb. 6.	P.	Wilson, Erasmus, Esq., Lecturer on Anatomy and Physiology, Middlesex Hospital. 55 *Upper Charlotte-street, Fitzroy-square.*
1801. Apr. 16.		Wilson, Sir Giffin, Knt. 2 *Stratford-place; and Woburn-house, Beaconsfield, Buckinghamshire.*
1796. Apr. 28.		Wilson, Glocester, Esq. *Hastings.*
1834. Apr. 10.		Wilson, Horace Hayman, Esq., M.A. M.R.A.S. Boden Professor of Sanscrit in the University of Oxford. 14 *Upper Wimpole-street.*
1846. Feb. 19.	†	Wilson, John, M.D. *Greenwich.*
1845. Feb. 6.	†	Wilson, Rev. John, D.D. M.R.A.S. Hon. Pres. Bombay Branch of the R.A.S. *Bombay.*
1834. June 5.		Witt, George, M.D. *Bedford.*
1813. Feb. 25.		Wix, Rev. Samuel, M.A. F.S.A. *Rectory-house, St. Bartholomew's the Less.*
1810. July 12.		Wix, William, Esq. *Tunbridge-wells, Kent.*
1829. Feb. 26.		Wollaston, Alexander Luard, Esq., M.B. F.R.A.S.
1812. Dec. 24.	*	Wood, William, Esq., F.L.S. *Ruislip, near Uxbridge.*
1836. Dec. 22.	†	Wood, William Page, Esq. 3 *Stone-buildings, Lincoln's-inn.*
1841. May 20.	†	Wood, Lieut.-Colonel Thomas. 26 *Hyde Park-gardens.*
1841. Apr. 29.	†	Woodward, Charles, Esq. 10 *Compton-terrace, Islington.*
1843. June 1.	†	Wright, Rev. John, M.A. F.S.A. F.R.A.S. M.R.S.L. 67 *Westbourne-terrace, Hyde-park-gardens; and The Vicarage, Malvern.*
1841. Apr. 29.	†	Wrottesley, John, Lord. *Wrottesley-hall, Wolverhampton.*
1839. Jan. 31.	†	Yates, James, Esq., M.A. F.L.S. F.G.S. 49 *Upper Bedford-place; and Norton-hall, Derbyshire.*

FOREIGN MEMBERS.

	Louis Agassiz	*Neufchatel.*	1838.
C.	François-Jean-Dominique Arago	*Paris.*	1818.
	F. G. A. Argelander	*Bonn.*	1846.
	Elie de Beaumont	*Paris.*	1835.
C.	Antoine César Becquerel	*Paris.*	1837.
C.P.	Jens Jacob Berzelius	*Stockholm.*	1813.
P.	Jean-Baptiste Biot	*Paris.*	1815.
Rm.	H. M. Ducrotay de Blainville	*Paris.*	1832.
	Baron Leopold von Buch	*Berlin.*	1828.
	Francesco Carlini	*Milan.*	1832.
	Augustin-Louis Cauchy	*Paris.*	1832.
	Michel-Eugène Chevreul	*Paris.*	1826.
	Auguste De la Rive	*Geneva.*	1846.
C.	Jean Dumas	*Paris.*	1840.
	Christian Gottfried Ehrenberg	*Berlin.*	1837.
R.	Johann Franz Encke	*Berlin.*	1825.
	Paul Erman	*Berlin.*	1827.
	P. Flourens	*Paris.*	1835.
C.	Karl Friedrich Gauss	*Göttingen.*	1804.
	P. A. Hansen	*Seeberg.*	1835.
	Christopher Hansteen	*Christiania.*	1839.
	Baron Alexander von Humboldt	*Berlin.*	1815.
	C. G. J. Jacobi	*Königsberg.*	1833.
	A. T. Kupffer	*St. Petersburgh.*	1846.
C.	U. J. J. Le Verrier	*Paris.*	1847.
C.	Baron von Liebig	*Giessen.*	1840.
	Baron von Lindenau	*Dresden.*	1833.
	Henry Frederic Link	*Berlin.*	1842.
	Joseph-Louis Gay-Lussac	*Paris.*	1815.
	Carl. Fried. Philip von Martius	*Munich.*	1838.
Rm.	Macédonie Melloni	*Naples.*	1839.
	C. F. Brisseau Mirbel	*Paris.*	1837.
R.	Eilert Mitscherlich	*Berlin.*	1828.
	Johann Müller	*Berlin.*	1840.
C.	Jens Christian Oersted	*Copenhagen.*	1821.
C.	George Simon Ohm	*Nuremberg.*	1842.
C.	Baron Giovanni Plana	*Turin.*	1827.
	Jean Victor Poncelet	*Paris.*	1842.
	G. de Pontécoulant	*Paris.*	1833.
	Lambert Adol. Jacques Quételet	*Brussels.*	1839.
	Henry Rose	*Berlin.*	1842.
	O. A. Rosenberger	*Halle.*	1835.
P.	Heinrich Christian Schumacher	*Altona.*	1821.
R.	Friedrich Georg Wilhelm Struve	*Pulkowa.*	1827.
C.	Jacques Charles François Sturm	*Paris.*	1840.
	Le Baron Thénard	*Paris.*	1824.
	Friedrich Tiedemann	*Heidelberg.*	1832.

FELLOWS DECEASED SINCE THE LAST ANNIVERSARY (Nov. 30, 1846).

On the Home List.

The Duke of Argyll.
Vice-Admiral Lord Amelius Beauclerk.
Right Hon. Sir John Beckett, Bart.
Robert Bingley, Esq.
William Bridgman, Esq.
Nicholas Carlisle, Esq.
Rev. William Dealtry, D.D.
Sir Richard Dobson.
Right Hon. Sir Edward Hyde East, Bart.
John Ellis, Esq.
Capt. John Grover.
Rev. John Hailstone.
Sir John Hamett, M.D.
Charles Hatchett, Esq.
Robert Masters Kerrison, M.D.
James MacCullagh, Esq.
Rev. John William Mackie.
Macvey Napier, Esq.
Hugh, Duke of Northumberland, K.G.
Venerable John Oldershaw, D.D.
John Parkinson, Esq.
Rev. William Pearson, D.D.
Sir George Pocock, Bart.
Sir David Pollock.
Rev. John Sleath, D.D.
Samuel Solly, Esq.
George Holme Sumner, Esq.
Peregrine Edward Towneley, Esq.
Samuel Turner, Esq.
Sir John Eardley Wilmot, Bart.

On the Foreign List.

Alexandre Brongniart.

DEFAULTERS.

William Burge, Esq. | William Hutton, Esq.

FELLOWS ADMITTED SINCE THE LAST ANNIVERSARY (Nov. 30, 1846).

On the Home List.

Date of Election.	
1847. Jan. 21.	Henry Wentworth Dyke Acland, M.D.
1847. Apr. 22.	Henry Alexander, Esq.
1847. Jan. 7.	Sir George Back, Capt. R.N.
1847. Apr. 15.	William Baly, M.D.
1847. Mar. 4.	Charles Brooke, Esq., B.A.
1847. Apr. 22.	George Burrows, M.D.
1847. Mar. 18.	James Robert Christie, Esq.
1847. Apr. 22.	Sir Fortunatus Dwarris, B.A.
1847. Apr. 15.	Thomas Flower Ellis, Esq., M.A.
1847. Apr. 22.	William Hutcheson Hall, Capt. R.N.
1847. Apr. 25.	Earl of Hardwicke.
1847. Apr. 22.	Joseph Dalton Hooker, M.D.
1847. Apr. 15.	John Gorham Maitland, Esq., M.A.
1847. Apr. 22.	Stephen, Earl of Mountcashel.
1847. June 3.	George, Viscount Morpeth.
1847. Apr. 22.	John Percy, M.D.
1847. Apr. 15.	William Henry Chicheley Plowden, Esq.
1847. Feb. 18.	Edward John Rudge, Esq.
1847. May 6.	Lord John Russell.
1847. Apr. 22.	Sir John Augustus Francis Simpkinson, Q.C.
1847. Mar. 18.	Thomas Webster, Esq., M.A.
1847. Nov. 25.	Field Marshal Arthur, Duke of Wellington, K.G.

On the Foreign List.

U. J. J. Le Verrier.

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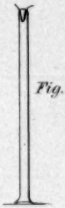

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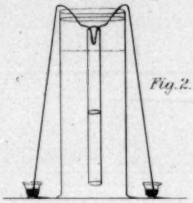

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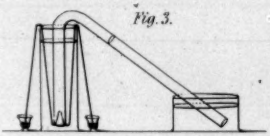
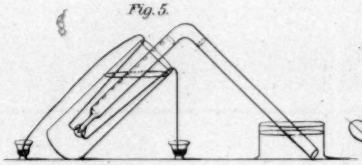


Fig. 3.

Fig. 4.



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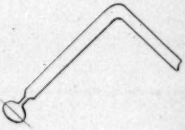

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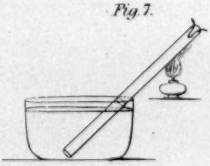

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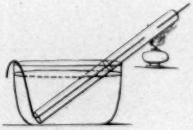

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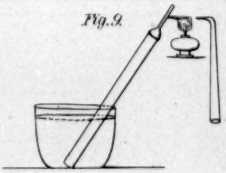

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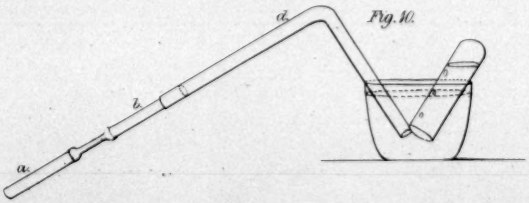
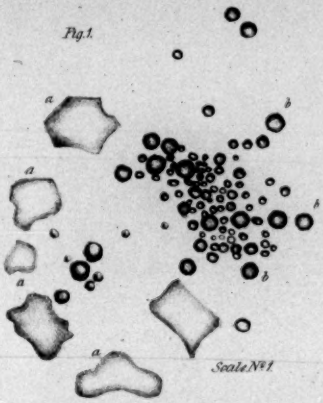


Fig. 10.

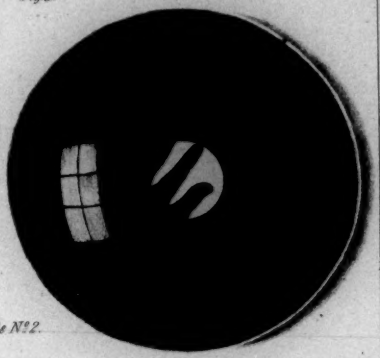
J. Basire lith.

Fig.1.



Scale No 1.

Fig.3.



Scale No 2.

Fig.2.

Scale No 1.

Fig.4.

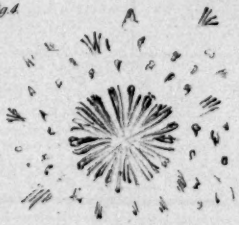
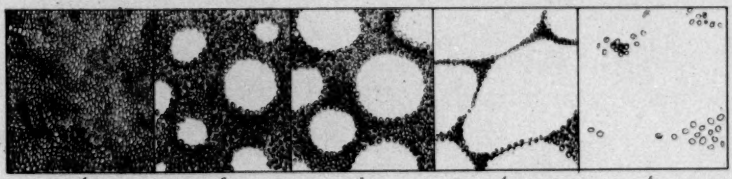


Fig.8.

Fig.5.

Scale No 1.



Scale No 1. 100th of millimetre.

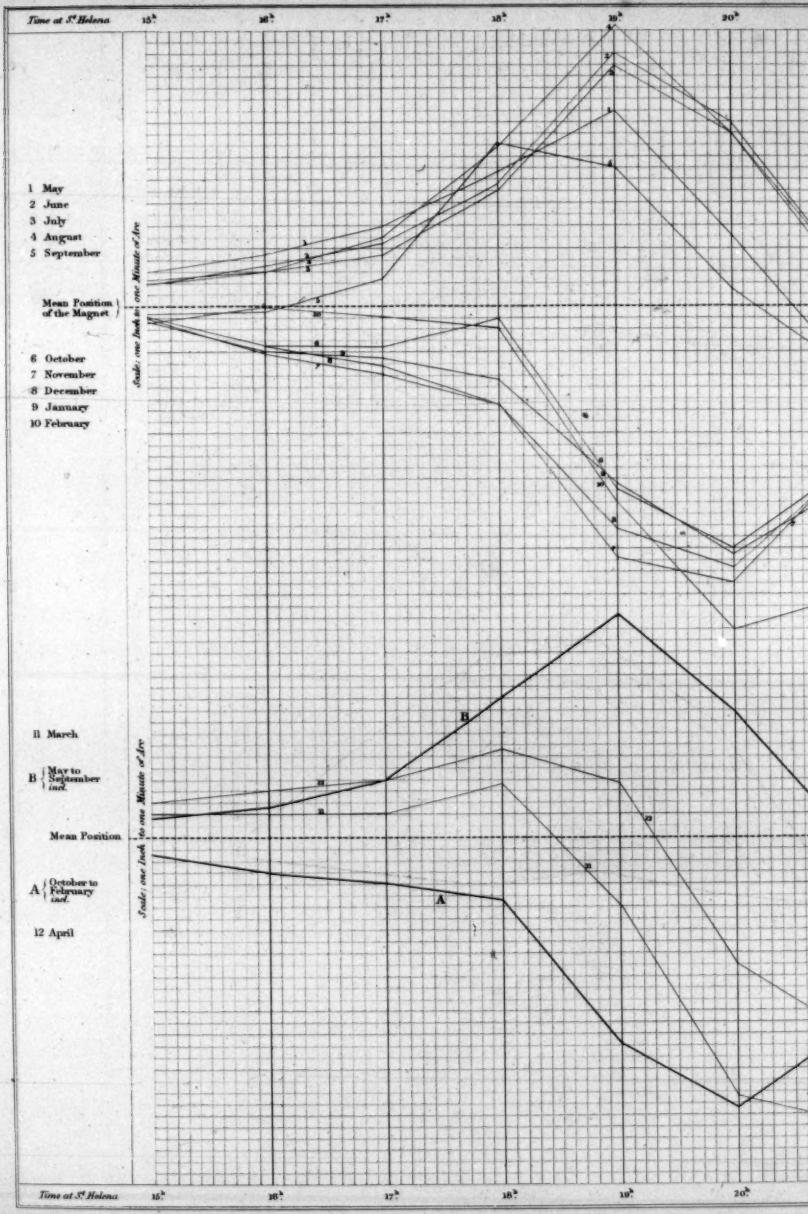
Scale No 2. 100th of millimetre.

Fig.6.

Fig.7.

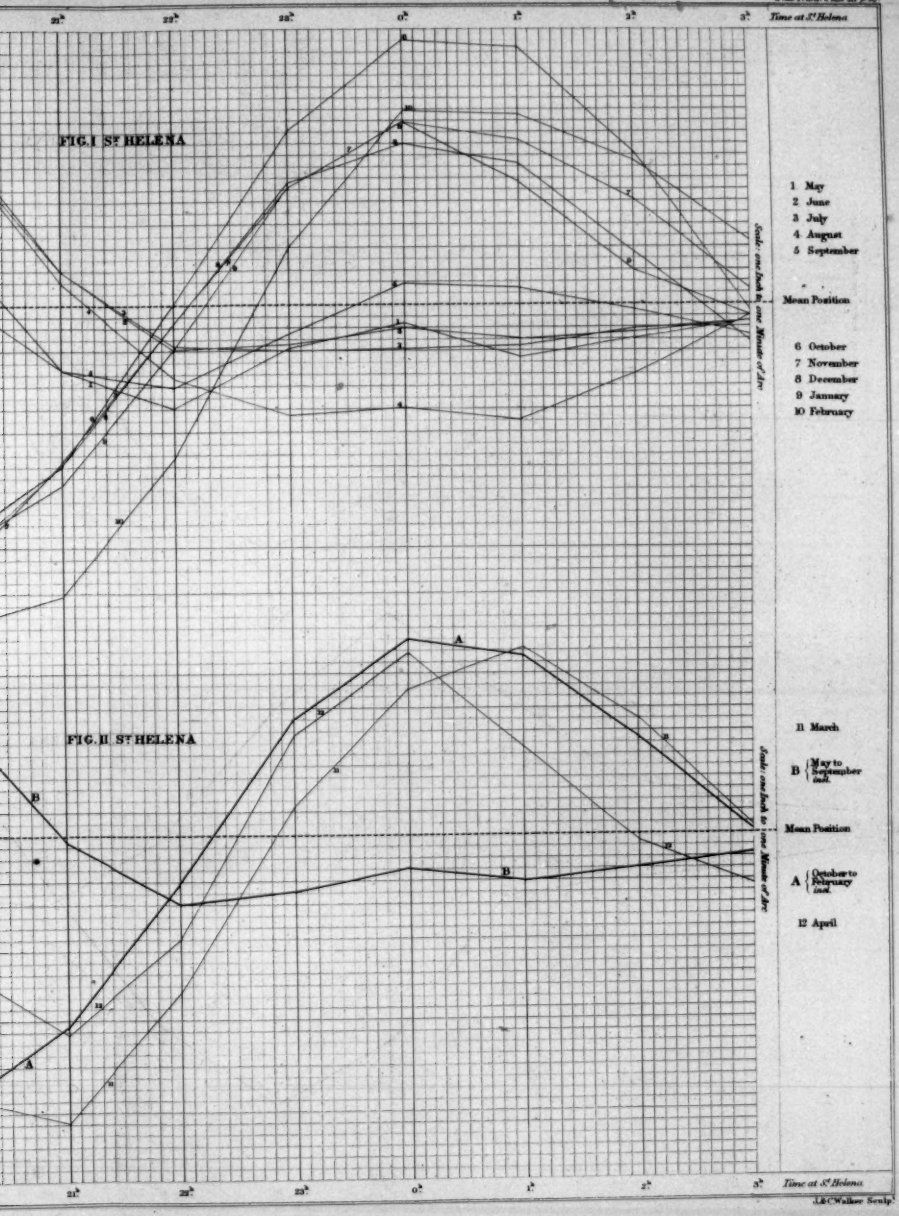
J Basire Lith.

DIURNAL VARIATION OF THE MAGNETIC DECLINAT



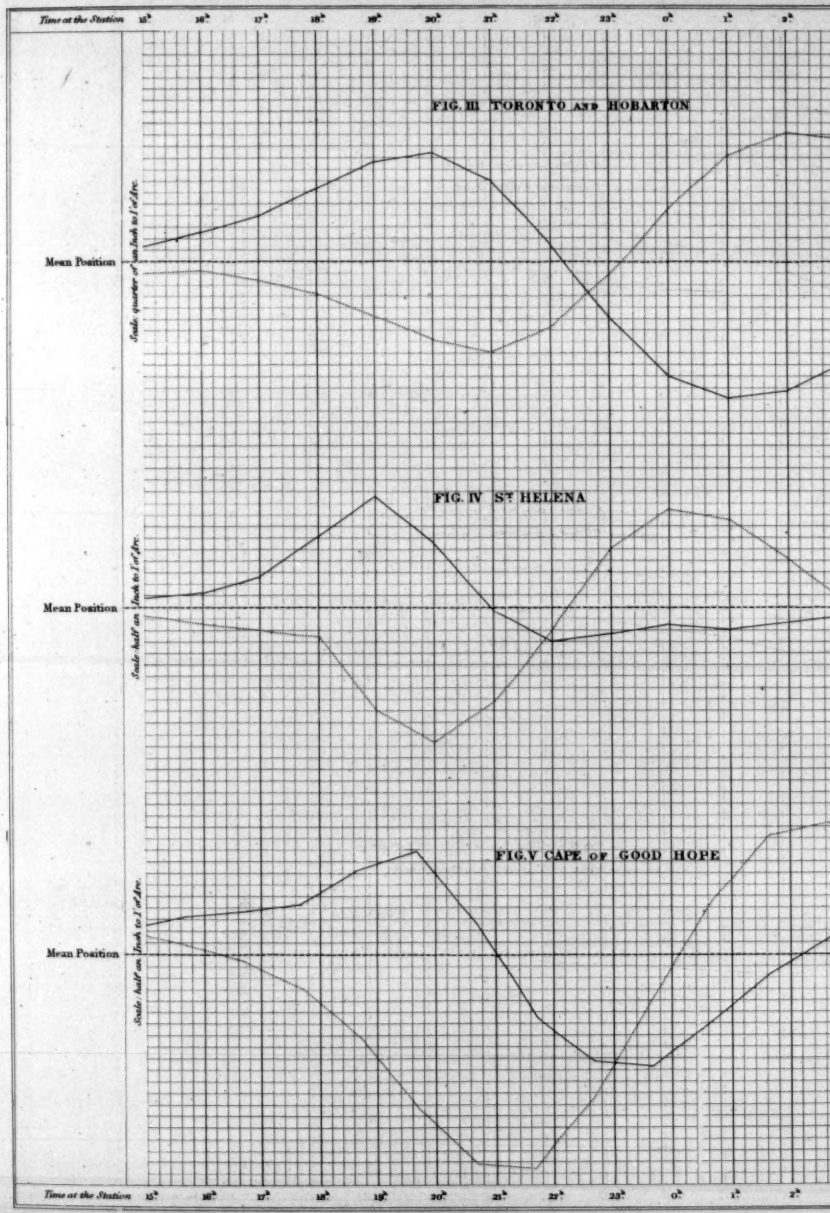
The NORTH end of the magnet moving towards the EAST, ↑ towards the WEST. ↓

Phil. Trans. Plate III. p. 55.

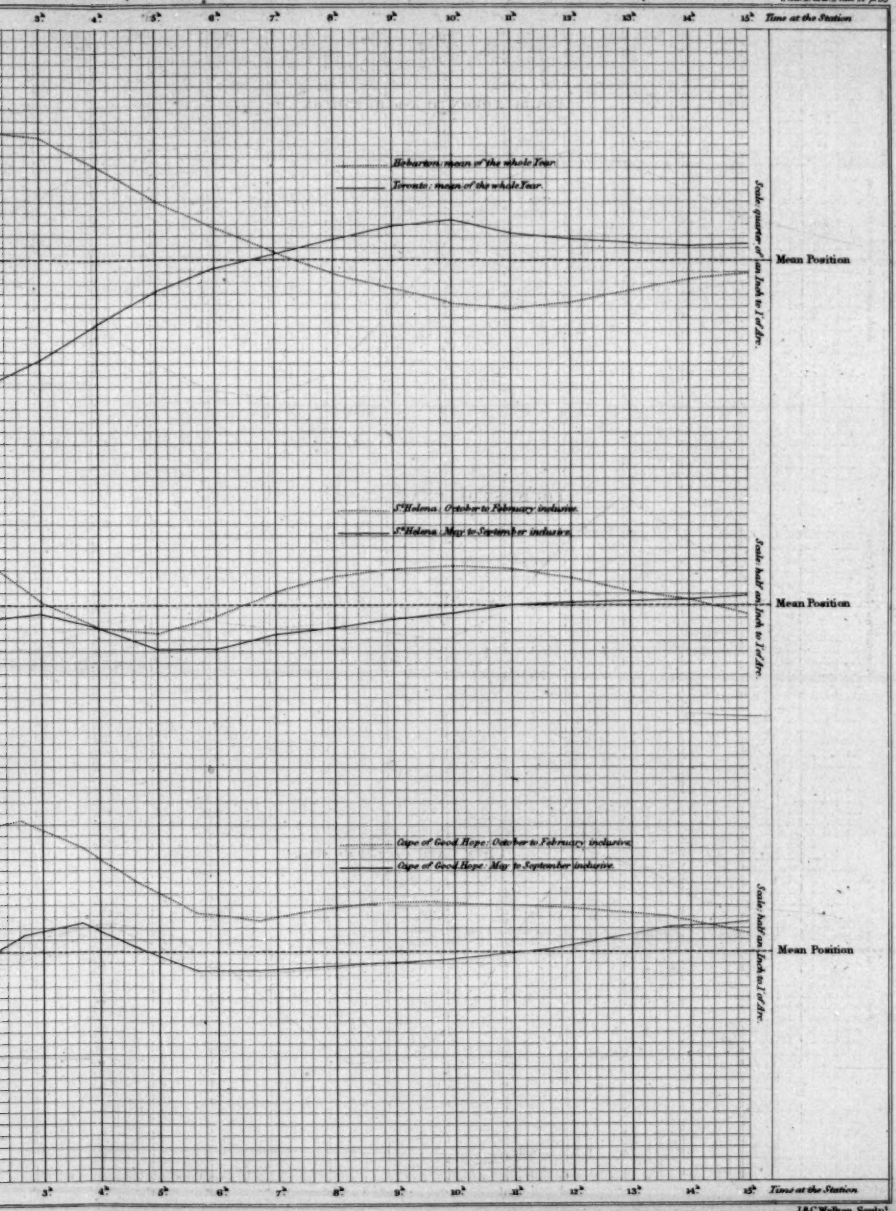


J. & C. Walker Sculp.

DIURNAL VARIATION OF THE MAGNETIC DECLINATION



The NORTH end of the magnet moving towards the EAST, ↑ towards the WEST. ↓


Time at the Station
Hobarton, mean of the whole Year
Toronto, mean of the whole Year
Scale quarter of an Inch to 1' of Dec.
Mean Position
St.t Helena, October to February inclusive
St.t Helena, May to September inclusive
Scale half an Inch to 1' of Dec.
Mean Position
Cape of Good Hope, October to February inclusive
Cape of Good Hope, May to September inclusive
Scale half an Inch to 1' of Dec.
Mean Position
Time at the Station

J & C. Walker Sculp.t

Fig. 8.

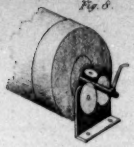
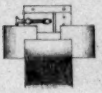
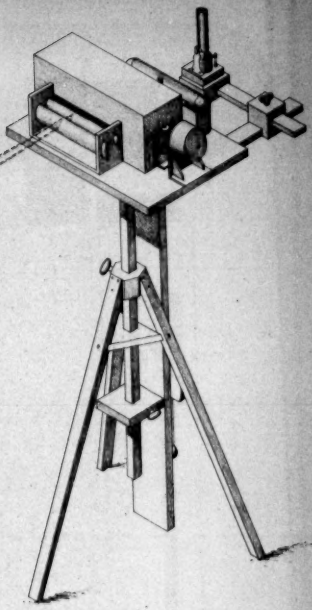


Fig. 1.





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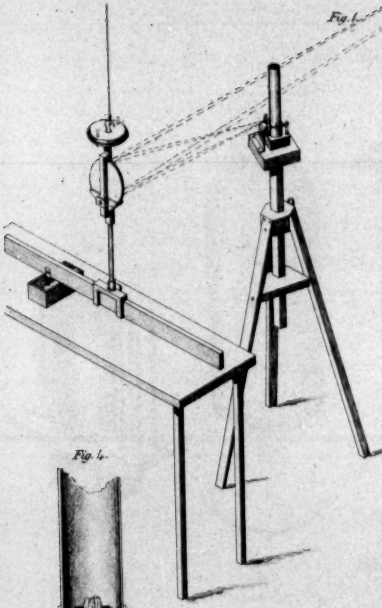


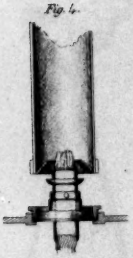
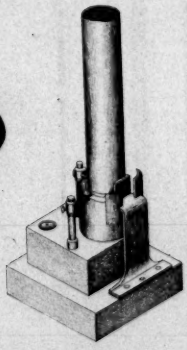


Fig. 5.

Fig. 3.



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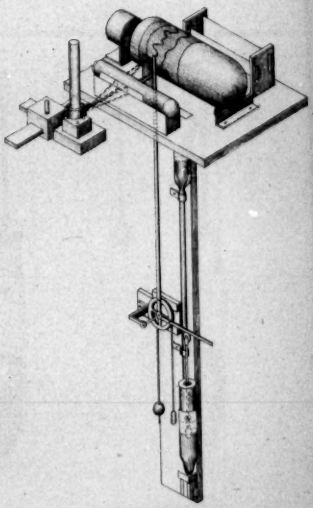


Fig. 6.

J.C. Oyle. del.

Fig. 3.

Fig. 1.

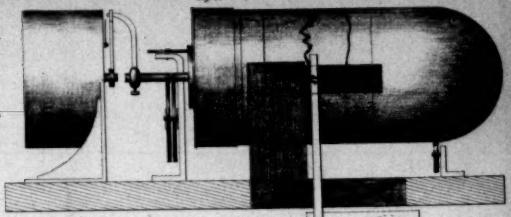
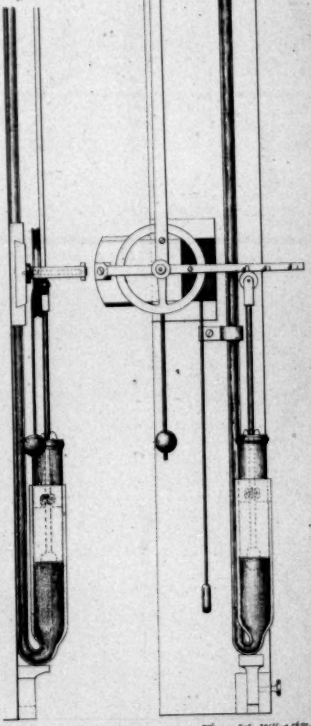


Fig. 9.

Fig. 11.

Fig. 5.

Fig. 2.



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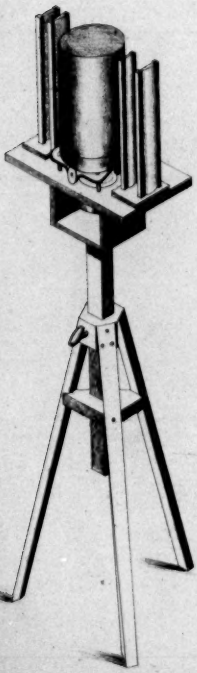


Fig. 6.

Fig. 10.

Fig. 7.

Fig. 8.

W. Bunyan Lithog. 76 Mark St. Bloomsbury.

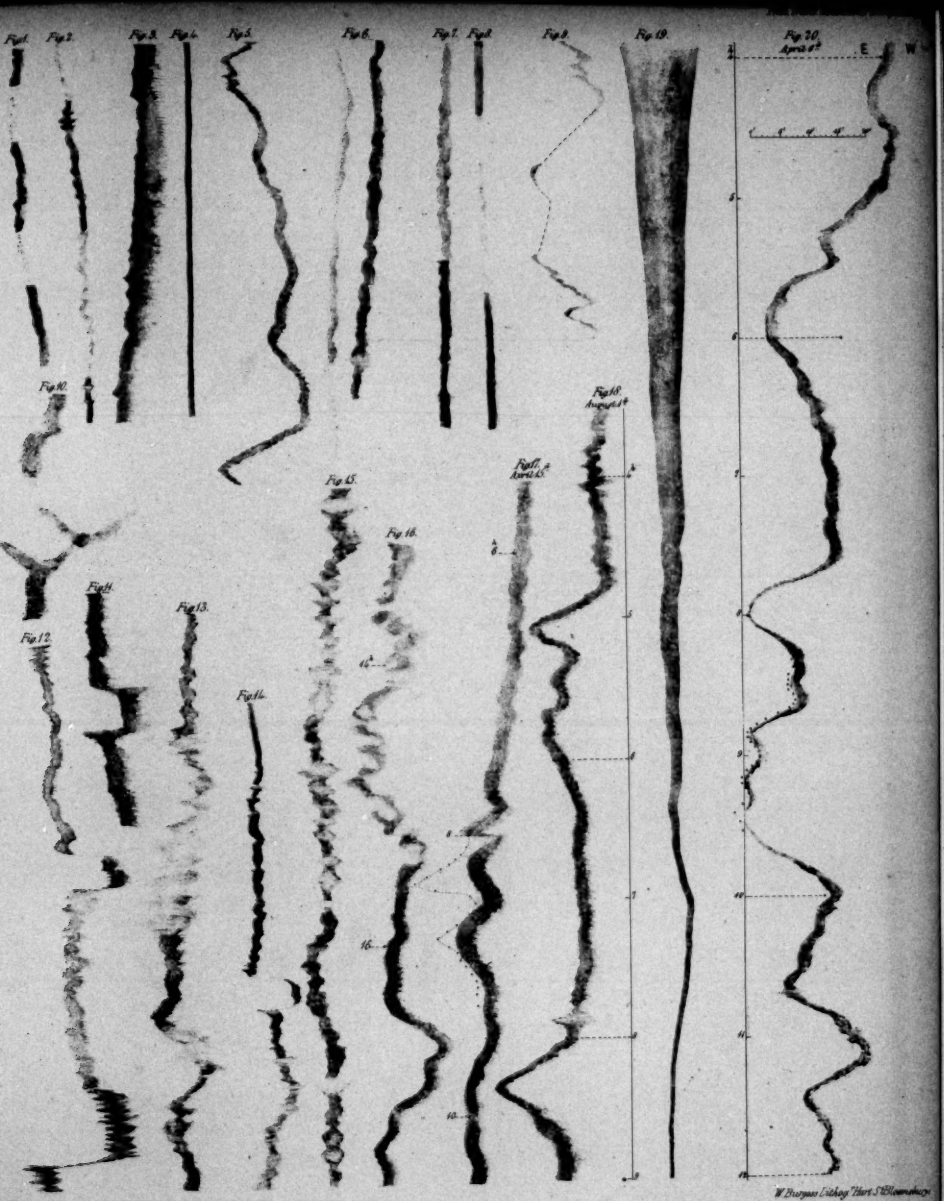


Fig 1.
Fig 2.
Fig 3.
Fig 4.
Fig 5.
Fig 6.
Fig 7.
Fig 8.
Fig 9.
Fig 10.
Fig 10
Fig 11.
Fig 12.
Fig 13.
Fig 14.
Fig 15.
Fig 16.
Fig 17.
Fig 18.
Fig 19.
Fig 20.
E
W
W. Burgess Lithog. Hart. St. Bloomsbury

Fig. 1.
April 16th

E W

Fig. 2.
August 28th term day.

E W

Fig. 3.
August 28th 29h

E W

Fig. 4

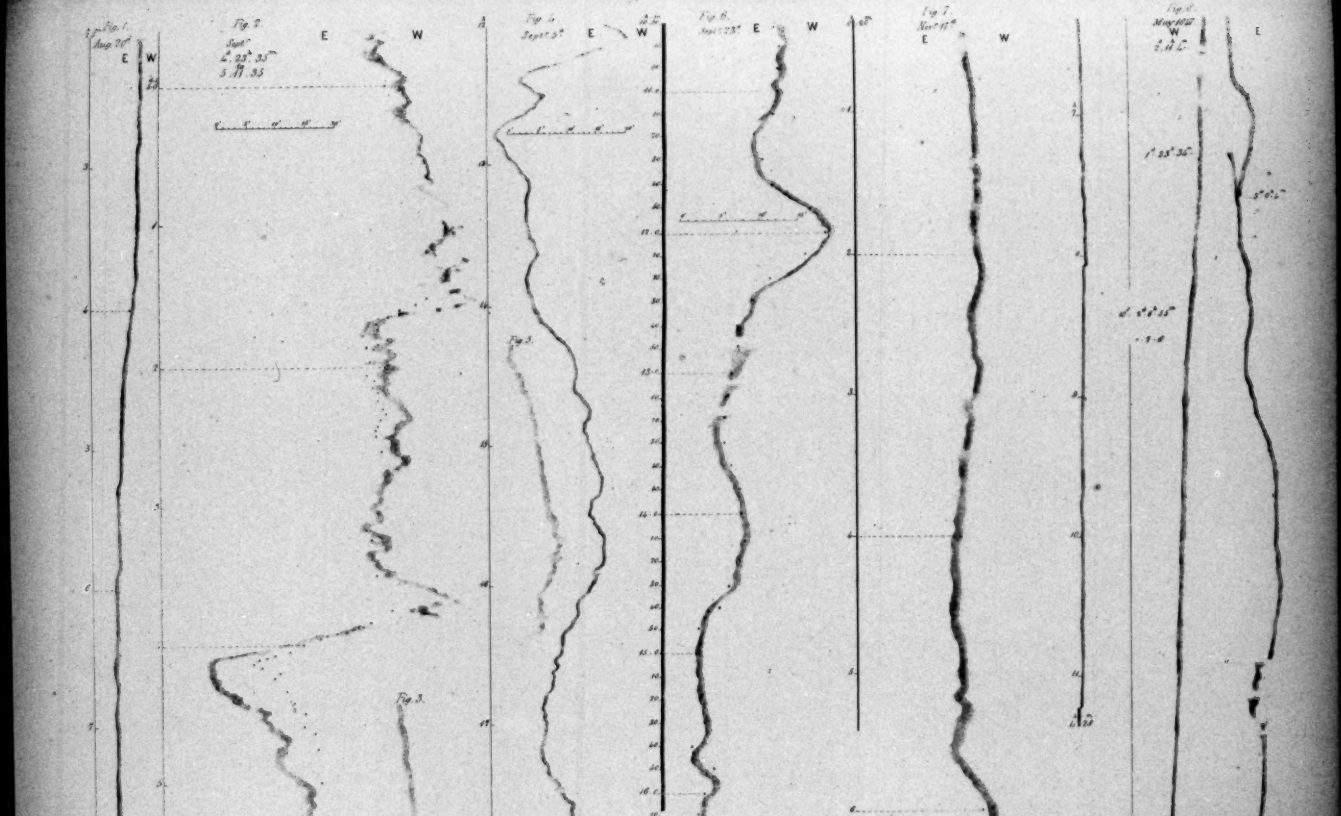


Fig. 1.
Aug. 20th
E
W
Fig. 2.
Sept.r
L. 25° 35'
S. 17. 35
E
W
Fig. 3.
Fig. 4.
Sept.r 3d
E
W
Fig. 5.
Fig. 6.
Sept.r 23d
E
W
Fig. 7.
Nov.r 11th
E
W
Fig. 8.
May 1858
W
L. 25° 36'
E

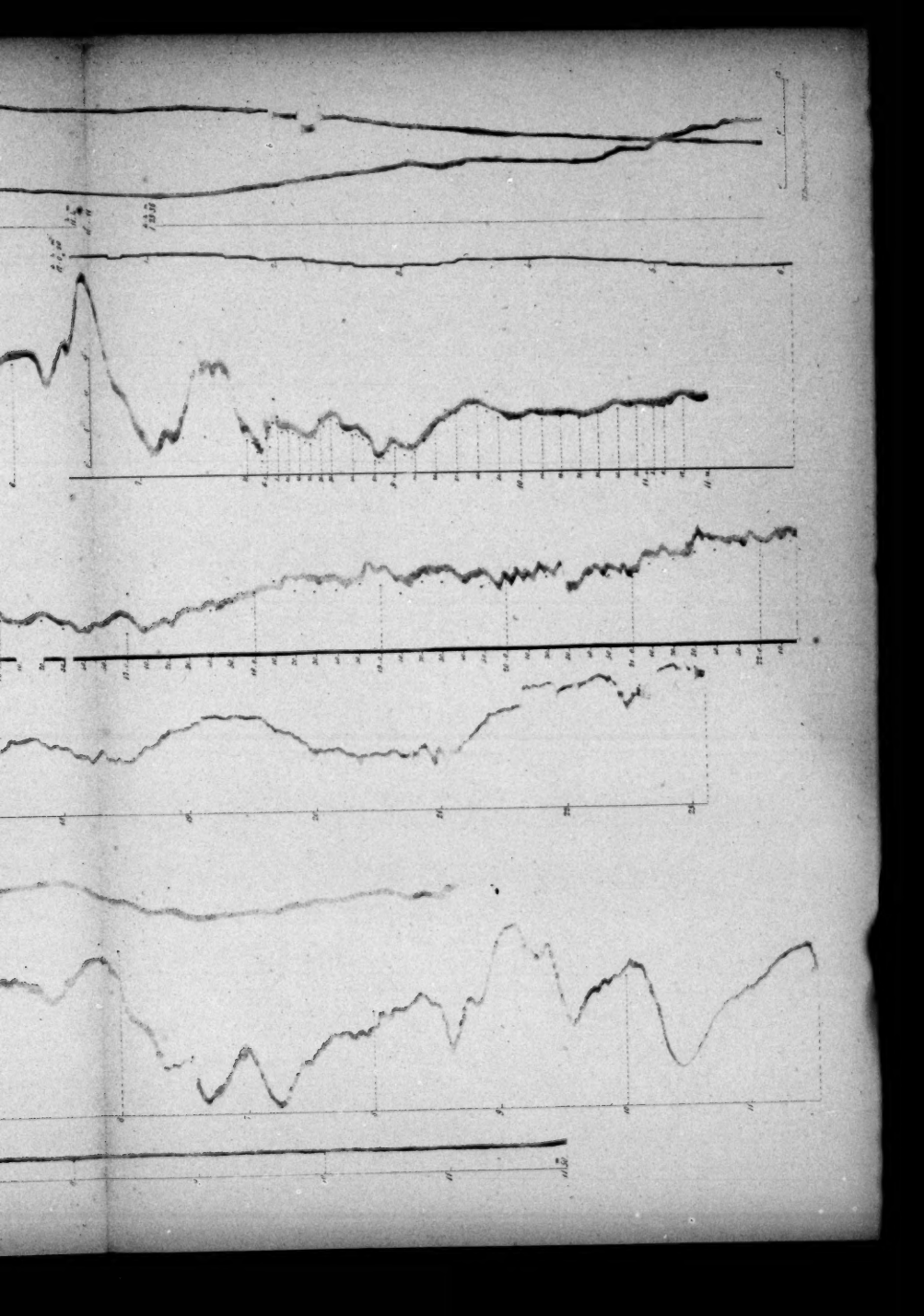


Fig. 1.

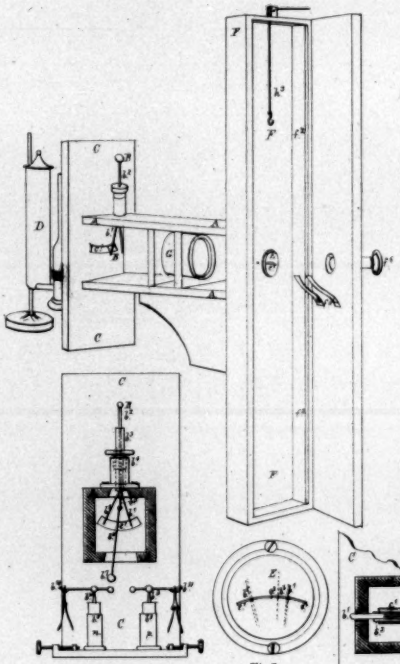


Fig. 2.

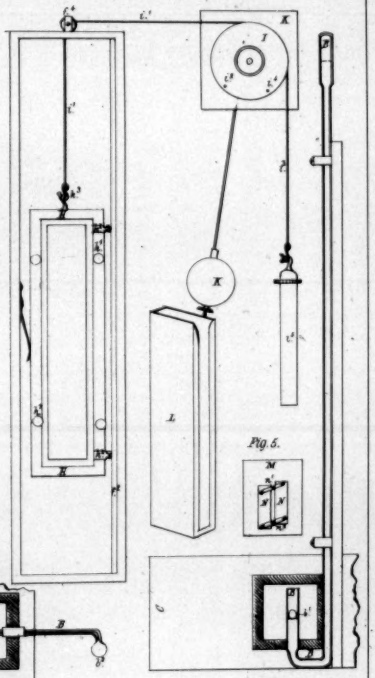


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 3.

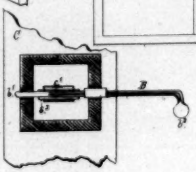
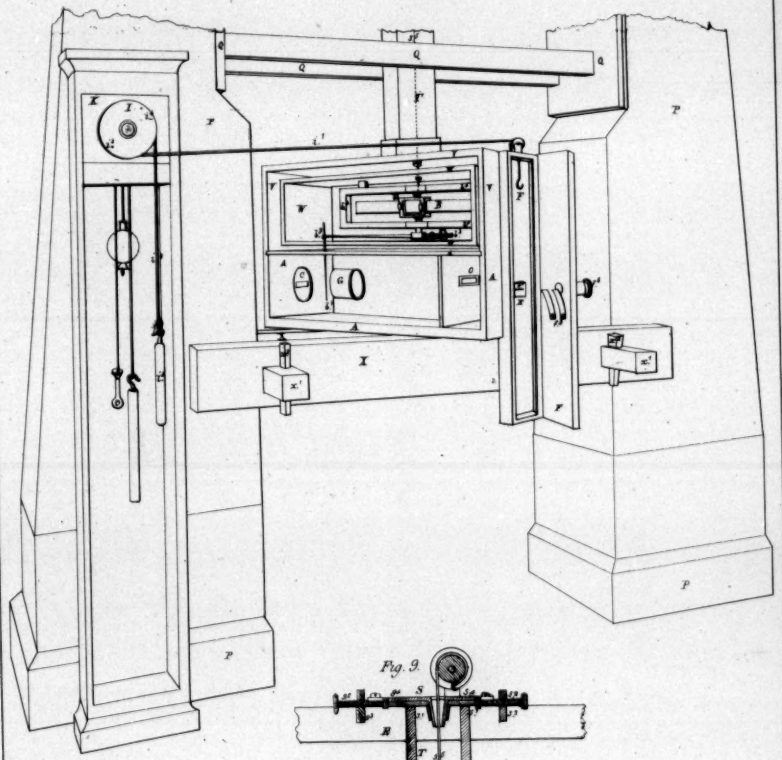


Fig. 4.

J. R. del.

J. Basire sculp.

Fig. 8.



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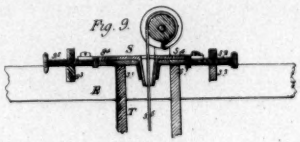


F.R. del.

J. Basire sculp.

Fig. 4.

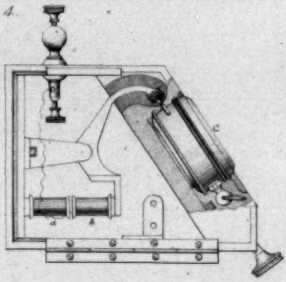


Fig. 3.

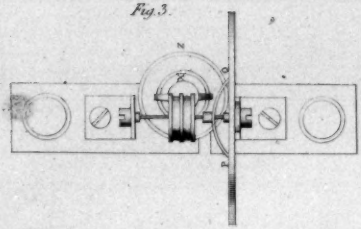
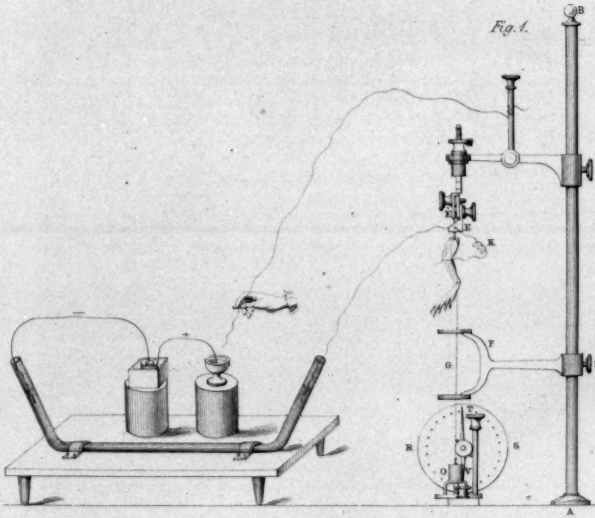


Fig. 1.



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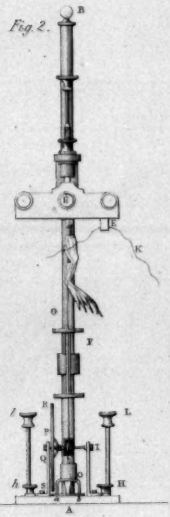
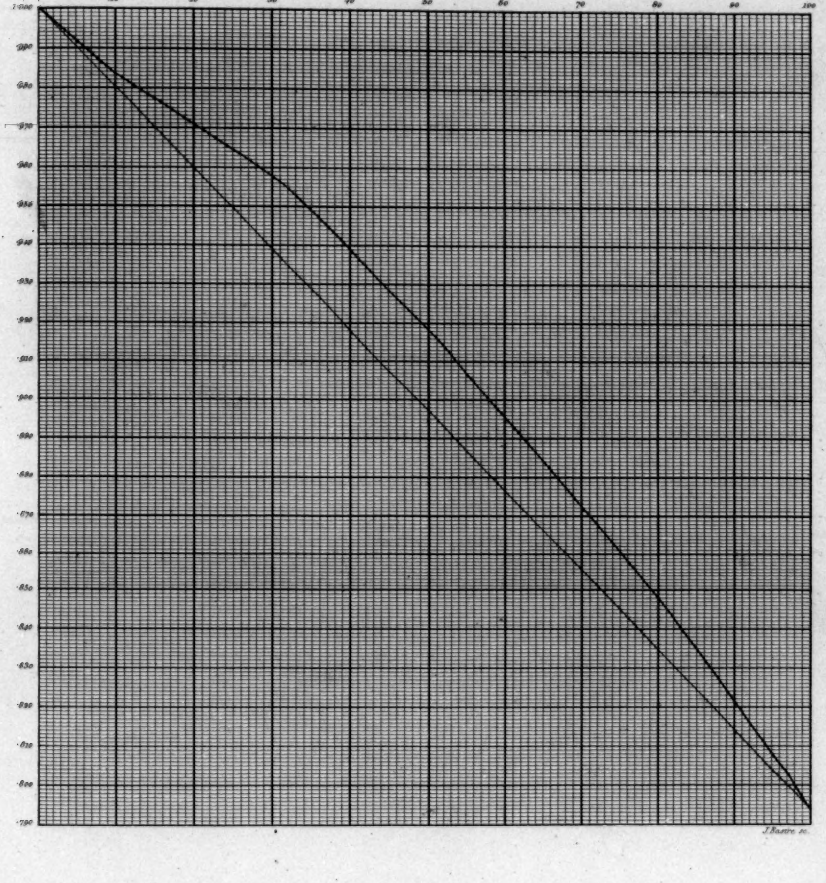


P. Piranesi del.

J. Basire Sc.

Comparison of mean and actual specific gravities of various mixtures of alcohol and water.